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PICKERING NGS 'B', UNIT 8, PHT PRESSURIZING AND CIRCULATING PUMPSET VIBRATION

Report No 86-311-K

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Mechanical Research Department

ABSTRACT

Commissioning tests to determine acceptability of pumpset dynamic and vibration characteristics are described. Some of the PHT circulating pumpsets have resonances near 1 x rpm, but these do not appear to affect vibration levels which are considered low. Vibration data at full unit load are presented for most pumpsets and are within recommended limits.

job	file	date	report no.
27-102-452	825.4	December 24, 1986	86-311-K

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EXECUTIVE SUMMARY

PICKERING NGS 'B', UNIT 8, PHT PRESSURIZING AND CIRCULATING PUMPSET VIBRATION

R.B. Jay and W.D. Morgan
Plant Equipment Dynamics Section
Mechanical Research Department

Assistance was provided to station personnel in the checkout and calibration of the Vibration Monitoring System (VMS) associated with the PHT pressurizing and circulating pumpsets, and in tests to determine acceptability of pumpset dynamic and vibration characteristics at normal full load operation.

Some of the PHT circulating pumpsets have structural resonances near 1 x rpm which are not considered of great consequence in view of the low levels of vibration at normal operating conditions.

Velocity and shaft runout levels on the one PHT pressurizing pumpset for which data are available are within recommended limits.

Velocity and shaft runout levels on the PHT circulating pumpsets, for which data are available, are within recommended limits.

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To Mr. K.H. Talbot
Commissioning Manager
Pickering NGS 'B'

PICKERING NGS 'B' UNIT 8, PHT
PRESSURIZING AND CIRCULATING PUMPSET VIBRATION

1.0 INTRODUCTION

Assistance was given to station personnel in the commissioning of the Primary Heat Transport Pressurizing and Circulating Pumpsets. The objectives were:

1. To evaluate the acceptability of pumpset vibration and dynamic characteristics with respect to specifications and/or industry standards.

2. To make recommendations for reducing pumpset vibration levels if in excess of limits specified in relevant tendering documents or specifications.

3. When necessary, to calibrate displacement and velocity transducers.

4. To check out, set-up and calibrate the vibration monitoring circuits associated with each pumpset.

Descriptions of the two pumpsets are given in Appendices A and B of Reference 1.

2.0 VIBRATION MONITORING SYSTEM

For a description of the VMS and more detailed specifications of the vibration sensors itemized below, refer to Reference 2.

2.1 Sensors on PHT Pressurizing Pumpsets

2.1.1 Velocity (Seismic)

A velocity transducer is mounted at the top of the motor, Figure 1. Provision is made for directing the sensitive axis vertically or, relative to the pumpset axis, radially or tangentially. It has been recommended and accepted, that the tangential direction be adopted for all pumpsets, as at

Pickering NGS 'A'. The orientation of the mounting at the top of the motor relative to the pumpset is not the same on all pumpsets as Figure 2 shows.

The velocity transducer is Metrix, Model 5166-08, stock code 641A1093.

2.1.2 Displacement (Shaft Runout)

Vibration displacement (shaft runout) refers to the transverse motion of a shaft, or a component on the shaft regarded as representing it relative to a frame or machine housing.

On the PHT pressurizing pumpset this measurement is from a non-contact probe/proximitor system, with the probe positioned and mounted as in Figures 1 and 2, and directed at the outer diameter of the coupling between the pump and motor.

The Bently Nevada noncontact probe/proximitor transducer system comprises:

Noncontact Probe: Bently Nevada Catalogue No 300-01-00-XX-36-02, Stock Code 639A4344. This stock code appears to cover probes with two different lengths: 64 and 76 mm (2.5" and 3.0"). When replacing faulty probes, care should be taken to ensure that the length of the replacement probe matches that of the faulty probe.

Proximitor: Bently Nevada, Series 7000, Stock Code 639A2223.

Probe/Proximitor Extension Cable: Bently Nevada Catalogue No 4454-108 Stock Code 639A4344.

2.1.3 Phase Marker

The phase marker is an Atlas Electronics electro-magnetic pickup, Part No 725148, Stock Code 742B8953.

Its orientation and mounting are shown in Figures 1 and 2.

2.2 Sensors on PHT Circulating Pumpset

2.2.1 Velocity (Seismic)

A velocity transducer is mounted at the top of the motor, Figure 5. Provision is made for directing the sensitive axis vertically or, relative to the pumpset axis, radially or tangentially. It has been recommended and accepted that the tangential direction be adopted for all pumpsets, as at Pickering NGS 'A'. The orientation of the mounting at the top

of the motor relative to the pumpset is the same for all pumpsets, Figure 4.

The velocity transducer is Metrix, Model 5166-08, Stock Code 641A1093.

2.2.2 Displacement (Shaft Runout)

Vibration displacement (shaft runout) refers here to the transverse motion of the lower flange of the pump-half coupling, Figure 3. The coupling is a tapered fit on the pump shaft and the concentricity of the outer diameter of the lower flange to the coupling bore is closely controlled, so a measurement of the outer diameter of the lower flange is representative of the shaft motion. The measurement is from a non-contact probe/proximitor system with the probe positioned and mounted as in Figures 4 and 5, and directed at the lower flange of the pump-half coupling.

Spacers are required under the probe mounting brackets, Figure 3, to raise the probe so that under normal operating conditions the probe is positioned at the mid-point of the flange.

The Bently Nevada noncontact probe/proximiter system comprises:

Noncontact Probe: Bently Nevada Catalogue No 300-01-00-XX-36-02, Stock Code 639A4344. This stock code appears to cover probes with two different lengths: 64 and 76 mm (2.5" and 3.0"). When replacing faulty probes care should be taken to ensure that the probe length matches that of the faulty probe.

Proximitor: Bently Nevada Catalogue No 4454-108, Stock Code 639A2223.

Probe/Proximitor Extension Cable: Bently Nevada Catalogue No 4454-108, Stock Code 639A4344.

2.2.3 Phase Marker

The phase marker is an Atlas Electronics electro-magnetic pickup, Part No 725148, Stock Code 742B8953.

Its orientation and mounting are shown in Figures 4 and 5.

2.3 Calibrations

2.3.1 Velocity (Seismic) Transducers

At the present time, velocity transducers cannot be satisfactorily calibrated in the field. Although equipment is

available for checking the sensitivity at a specific frequency, this is not always satisfactory since changes in the overall frequency response can and do occur which could remain undetected.

The velocity transducers used on the PHT Pressurizing and Circulating Pumpsets were calibrated by the manufacturer. The calibration test data are attached to a copy of Manual NK30-WAH-60436-9009, assigned to Mr. S.S. Grewal of Pickering NGS 'B'.

2.3.2 Displacement (Shaft Runout) Transducers

The Non-contact Probe/Proximitor Transducer System is calibrated as described in Reference 2. Calibrations were performed on all pumpsets and the sensitivities are given in the tables following:

PHT PRESSURIZING PUMPSETS -
PROBE/PROXIMITOR SENSITIVITIES

Pumpset No.	1	2
V/mm mV/mil	3.62 92	3.82 97

PHT CIRCULATING PUMPSETS -
PROBE/PROXIMITOR SENSITIVITIES

Pumpset No	1	2	3	4	5	6	7	8
V/mm mV/mil	4.02 102	3.86 98	4.29 109	4.29 109	3.98 101	3.86 98	3.86 98	3.90 99
Pumpset No	9	10	11	12	13	14	15	16
V/mm mV/mil	3.78 96	4.02 102	3.98 101	3.90 99	4.09 104	4.29 109	4.13 105	4.21 107

Based on the calibration data, optimum gap voltages were selected as in the table below:

PHT PRESSURIZING PUMPSETS - GAP VOLTAGES

Pumpset No.	1	2
Gap Volts	8.0	8.0

PHT CIRCULATING PUMPSETS - GAP VOLTAGE

Pumpset No	1	2	3	4	5	6	7	8
Gap Volts	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Pumpset No	9	10	11	12	13	14	15	16
Gap Volts	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0

2.3.3 Circuit Calibrations

Single point circuit calibrations as described in Reference 2 were performed for all pumpsets.

PHT Pressurizing Pumpsets

For normal VMS operation, the nominal full scale ranges selected in the Unit Computer and by pin jacks on the seismic and proximity (shaft displacement or runout) printed circuit boards, are 17 mm/s pk and 0.300 mm p-p, respectively. These correspond to the M (medium) gain settings and were used for the calibrations.

For the seismic circuits, the calibration voltage input was 20 mV rms, which for a nominal velocity transducer sensitivity of 3.35 mV/mm/s (85 mV/in/s) corresponds to a computer readout of 8.45 mm/s/pk (0.33 in/s).

For the proximity circuits the calibration voltage input was 210 mV rms which for a nominal probe/proximitor sensitivity of 3.94 V/mm (100 mV/mil) corresponds to a computer readout of 0.150 mm p-p.

The following computer readouts were obtained:

COMPUTER READ-OUTS FOR CALIBRATION INPUTS EQUIVALENT TO 8.45 mm/s and 0.150 mm

Pumpset No	1	2
Velocity mm/s (pk)	8.45	8.45
Runout mm (p-p)	0.150	0.150

PHT Circulating Pumpsets

For normal VMS operation, the nominal full scale ranges selected in the Unit Computer, and by pin jacks on the seismic and proximity (shaft displacement or runout) printed circuit boards are 5.6 mm/s pk and 0.300 mm p-p, respectively. These correspond to the H (High) and M (Medium) gain settings respectively. With a siesmic circuit full scale range setting of 5.6 mm/s, circuit calibration is difficult. To overcome this difficulty, in Units 5 to 7 the full scale range settings in the Unit computers and on the seismic circuit boards were set to 17 mm/s.

For Unit 8 a change of the full scale range in the computer was inconvenient so a revised calibration procedure was used in which the full scale range on the seismic circuit board only was changed to 17 mm/s. The injection of the usual calibration voltage of 20 mv rms (corresponding to medium scale) then causes a seismic circuit board dc output to the computer of 2.5 vdc/2,7/. This voltage cannot be read correctly in vibration units by the computer because of the mismatch in full scale range settings, but can be read as a voltage. The computer readouts obtained using this modified procedure are given in the table below.

For the proximity circuits the calibration voltage input was 210 mV rms which for a nominal probe/proximitor sensitivity of 3.94 V/mm (100 mV/mil) corresponds to a computer readout of 0.150 mm p-p.

The following computer readouts were obtained:

COMPUTER READOUTS FOR CALIBRATION INPUTS
EQUIVALENT TO 2.5 Vdc(8.45 mm/s) and 0.150 mm

Pumpset No	1	2	3	4	5	6	7	8
Velocity v(dc)	2.50	2.49	2.50	2.50	2.50	2.50	2.49	2.50
Runout mm(p-p)	.150	.150	.150	.150	.150	.150	.150	.150
Pumpset No	9	10	11	12	13	14	15	16
Velocity v(dc)	2.50	2.50	2.50	2.50	2.50	2.49	2.50	2.50
Runout mm(p-p)	.150	.150	.150	.150	.150	.150	.150	.150

2.4 Full Scale Range Settings

The Signal Conditioners and the setting of their full scale ranges are discussed in Reference 2. During commissioning, the ranges found most suitable for PHT pressurizing and circulating pumpsets were as below:

Vibration Velocity (Seismic):

PHT Pressurizing Pumpset: 17 mm/s/pk
PHT Circulating Pumpset: 5.6 mm/s/pk

Vibration Displacement (Shaft Runout):

PHT Pressurizing Pumpset: 0.30 mm p-p
PHT Circulating Pumpset: 0.30 mm p-p

Note that the computer and signal conditioner full scale ranges must be the same for correct readouts in the computer display.

2.5 Vibration Alarms

2.5.1 Alarm Setting

The alarm function is performed by the Unit Computer. For the setting of alarm levels refer to relevant station information and procedures.

2.5.2 Alarm Limits - PHT Pressurizing Pumpset

Vibration Velocity: From/3/ the recommended all-pass vibration velocity levels for the PHT pressurizing pumpset motor are:

No load; motor on stiff base; no pump;	1.99 mm/s pk
Full load; level at which motor bearings will have 100,000 HR life:	2.82 mm/s pk
Shutdown level; significant defect; perform maintenance as soon as possible:	7.94 mm/s pk
Shutdown level; acute defect; shutdown motor:	15.8 mm/s pk

Shaft Runout: The limit recommended in the Station Operating Manual/4/ is 0.13 mm p-p (0.005 in p-p).

2.5.3 Alarm Limits - PHT Circulating Pumpset

Vibration Velocity: From/5/ the recommended vibration levels (presumed to be all pass) for the PHT circulating pumpset motors are:

Alarm Limit:	0.051 mm p-p (2 mils p-p)
Shutdown Limit:	0.076 mm p-p (3 mils p-p)

At 30 Hz (operating speed) the equivalent velocities are:

Alarm Limit:	4.8 mm/s pk (30 Hz)
Shutdown Limit:	7.2 mm/s pk (30 Hz)

Shaft Runout: The limit recommended in the Station Operating Manual/6/ is 0.18 mm p-p (0.007 in p-p). As an operating limit this may be satisfactory but the data presented in Figure 11 of Reference 1 suggest that for newly commissioned pumpsets it may be too high. For newly commissioned pumpsets a limit of 0.12 mm p-p (0.0045 in p-p) is proposed and for operating pumpsets a shutdown limit of 0.24 mm p-p (0.009) in p-p).

3.0 PUMPSET COMMISSIONING TESTS

Structural natural frequencies of pumpsets were determined by impact tests performed when all the pumpsets were idle by striking the top of the motor with an elastomeric-tipped hammer instrumented with a force transducer. The pumpset response was measured by a magnetically mounted accelerometer driving a charge amplifier. The force and response signals were fed to a dual channel FFT frequency analyzer/plotter set to produce plots

of compliance transfer functions, from which structural natural frequencies are obtained. The plots are presented in Appendices A and B.

Test instrumentation is listed in Table I.

3.1 PHT Pressurizing Pumpsets

3.1.1 Check for Structural Resonances

Impact tests were carried out as in 3.0; the spectra obtained are in Appendix A.

3.1.2 Unit at Full Load

Mean vibration levels from trend plots in Appendix C are given below:

VIBRATION AT FULL LOAD
MEAN VALUES FROM TREND PLOTS IN APPENDIX C

Pumpset	1	2
Date	-	86-07-23
mm/s (p)	-	2.0
mm (p-p)	-	0.046

Velocity and displacement spectra (obtained in real time or from taped records of the buffered ac output, using a Nicolet 660 B FFT dual channel analyzer) are given in Appendix D.

3.2 PHT Circulating Pumpsets

3.2.1 Check for Structural Resonances

Impact tests were performed as in 3.0. Spectra of compliance transfer functions are given in Appendix B.

3.2.2 Unit at Full Load

Mean vibration levels from trend plots in Appendix E are given below.

Pumpset No	1	2	3*	4	5*	6	7	8
Date	86-07-23	86-07-23	-	86-07-23	-	86-07-23	86-07-23	86-07-23
mm/s (p)		1.20	-	0.81	-	1.23	0.90	1.11
mm (p-p)	0.054	0.057	-	0.114	-	0.111	0.043	0.070
Pumpset No	9	10	11	12*	13	14*	15	16
Date	86-07-23	86-07-23	86-07-23	-	86-07-23	-	86-07-23	86-07-23
mm/s (p)	1.20	1.31	1.29	-	1.01	-	0.74	1.69
mm (p-p)	0.047	0.081	0.061	-	0.028	-	0.029	0.031

*Data not available - pumpsets not in service.

Velocity and displacement spectra (obtained in real-time or from taped records of the buffered ac output using a Nicolet 660 B FFT dual channel analyzer) are given in Appendix F.

4.0 DISCUSSION OF RESULTS

4.1 PHT Pressurizing Pumpsets P1 and P2

4.1.1 Structural Resonances

Impact spectra in Appendix A show no significant resonances at operating speed (60 Hz) or its harmonics.

4.1.2 Unit at Full Load

Vibration against time for pumpset P2 (the only pumpset for which data are available) is displayed in Figure C1, Appendix C.

The table in 3.1.2 above summarizes this data and shows that, for pumpset P2 the mean vibration velocity is 2.0 mm/s, well within the limit for a 100,000 hr motor bearing life quoted in 2.5.2, and that the mean shaft displacement is 0.046 mm, well within the limit of 0.13 mm.

4.2 PHT Circulating Pumpsets

4.2.1 Structural Resonances

Few pumpsets show evidence of resonance at 30 Hz or its harmonics. When present the evidence suggests weak resonances showing little response that appear to have no significant effect on pumpset vibration velocities which are generally below 1.31 mm/s at normal full Unit load (see table in 3.2.2). Under severely abnormal operating conditions these resonances could be expected to contribute to greater vibration levels, but experience on Unit 5 (see Section 4.4.2 of Reference 1) indicates that these would not exceed the shutdown limit of 7.2 mm/s.

4.2.2 Unit at Full Load

Mean levels of vibration from the VMS Unit Computer trend plots in Appendix E are tabulated in 3.2.2. Examination of the table shows that vibration velocities are all low and (for the pumpsets for which data are available) well below the recommended alarm limit of 4.8 mm/s quoted in 2.5.3. The same table shows that the shaft runouts for all these pumpsets except P10 are below 0.12 mm, the limit proposed in Reference 1 for newly commissioned pumpsets, and for all pumpsets including P10, are well below the limit of 0.18 mm recommended in the station manual.

5.0 TAPE RECORDINGS

Whenever possible the vibration of pressurizing and circulating pumpsets was recorded at full unit load. Tape numbers and a log of the recordings are in Appendix G.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 PHT Pressurizing Pumpsets

At normal full unit load vibration velocity at the top of the motor and shaft displacement (runout) for pumpset P2, were within the recommended limits quoted in 2.5.2.

In the Vibration Room the buffered ac output for pumpset P2 shaft displacement (runout) is faulty and should be rectified.

6.2 PHT Circulating Pumpsets

At normal full unit load, vibration velocities at the top of the motors of all pumpsets except P3, P5, P12 and P14, for which data are not available, were within the recommended limit of 4.8 mm/s quoted in 2.5.3. Also, for the same twelve pumpsets, excluding P10, the shaft displacements (runouts) were within a

proposed limit of 0.12 mm for newly commissioned pumpsets/1/, and all twelve were well within the limit of 0.18 mm recommended in the station manual.

Approved:

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Technologist
Plant Equipment Dynamics Section

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2. R.B. Jay, W.D. Morgan, "Pickering NGS 'B', Vibration Monitoring System", Research Division Report No 83-392-K. October 28, 1983.

3. Inter-office Memo from L. Braun, Power Equipment, to R.B. Jay, "Primary Heat Transport Pressurizing Pump Motors", June 9, 1982.

4. Station Operating Manual, for PHT Pressurizing Pumpsets NK30-WAH-33312-9022.

5. Inter-office Memo from L. Braun, Power Equipment, to R.B. Jay, "Primary Heat Transport Pump Motors", June 7, 1982.

6. Station Operating Manual, for PHT Circulating Pumpsets NK30-WAH-33122-9036.

7. Brown, R.D. "Vibration Signal Conditioners, Pickerings GS - Instruction Manual Research Division Report No 76-330-K. November 17, 1976.

TABLE I

TEST INSTRUMENTATION

Accelerometer/charge amp

660 B/plotter

Instrumented Hammer Grey tip (0-200 Hz)
Green tip (0-500 Hz)

Accelerometer, B&K Model 4368

Charge Amplifier, BK Model 2635, set to LLF 2 Hz, ULF 1 kHz.

PICKERING NGS 'B' - PRESSURIZING PUMPSET

Typical Vibration Sensor Mountings

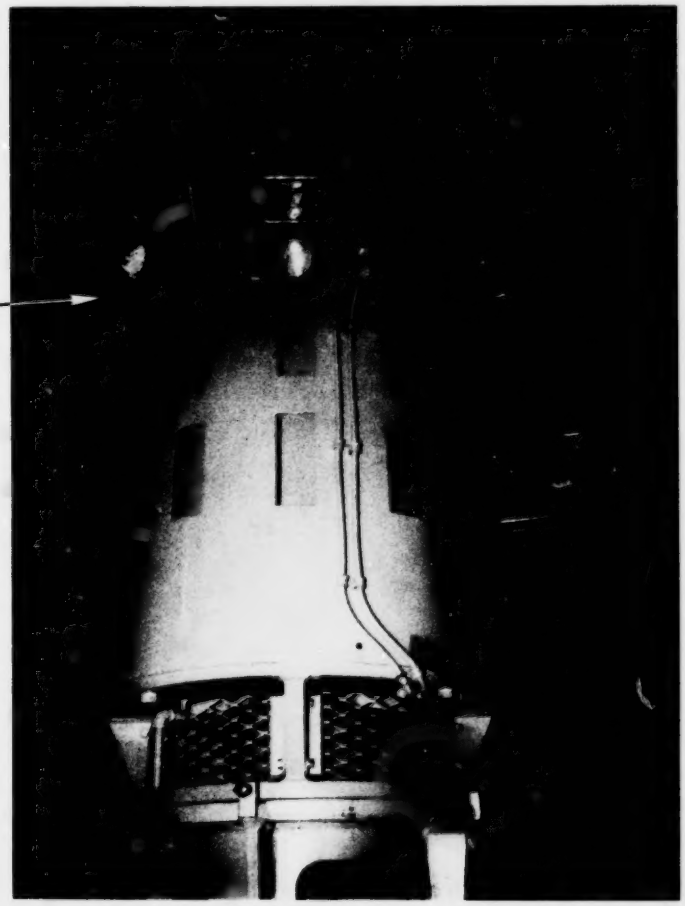

FIGURE 1

PICKERING NGS 'B' - PHT PRESSURIZING PUMPSETS

ORIENTATION OF VIBRATION SENSORS

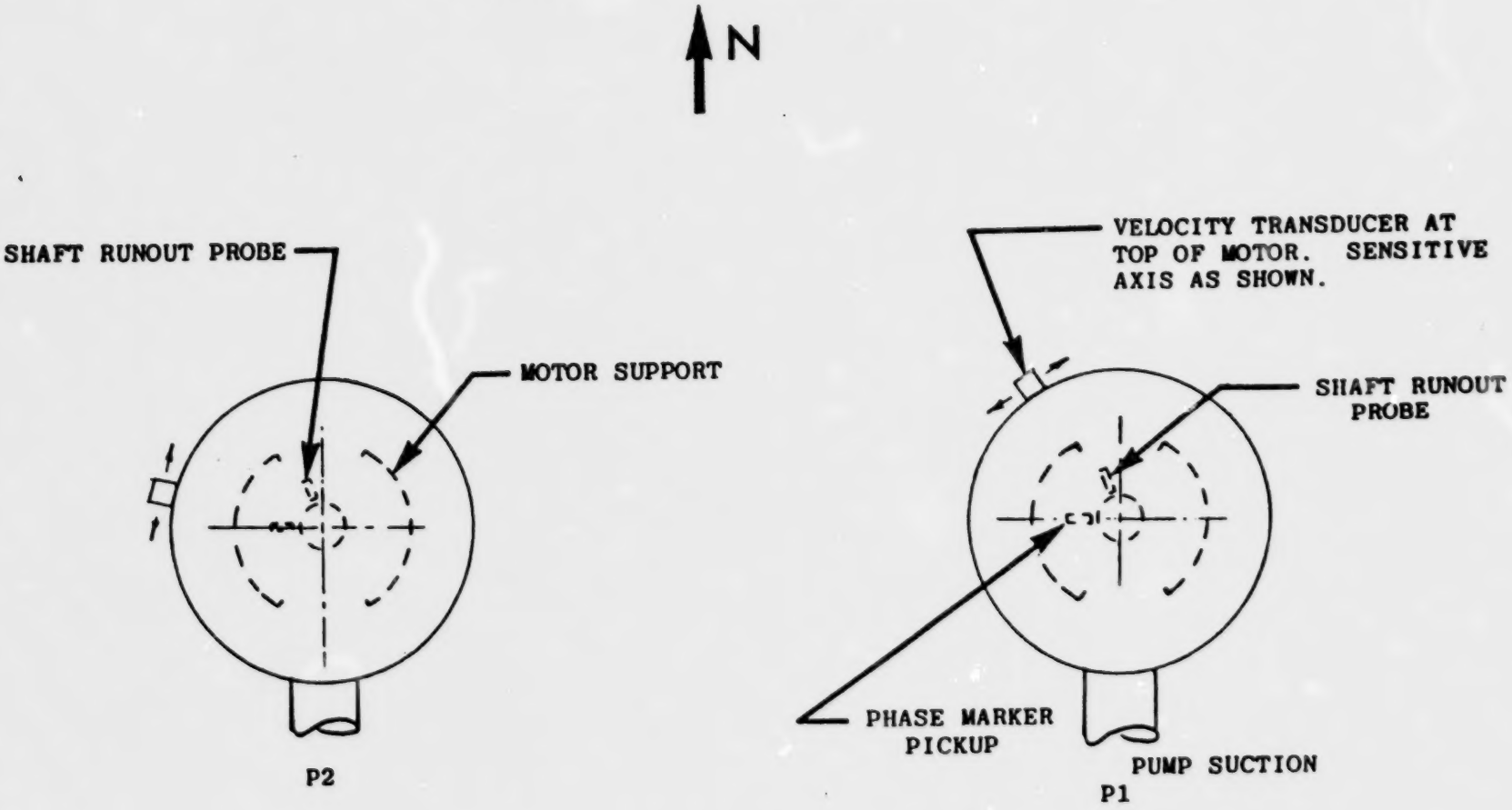

FIGURE 2

171077RD

PICKERING NGS 'B' - PHT CIRCULATING PUMPSET

SHAFT RUNOUT PROBE INSTALLATION

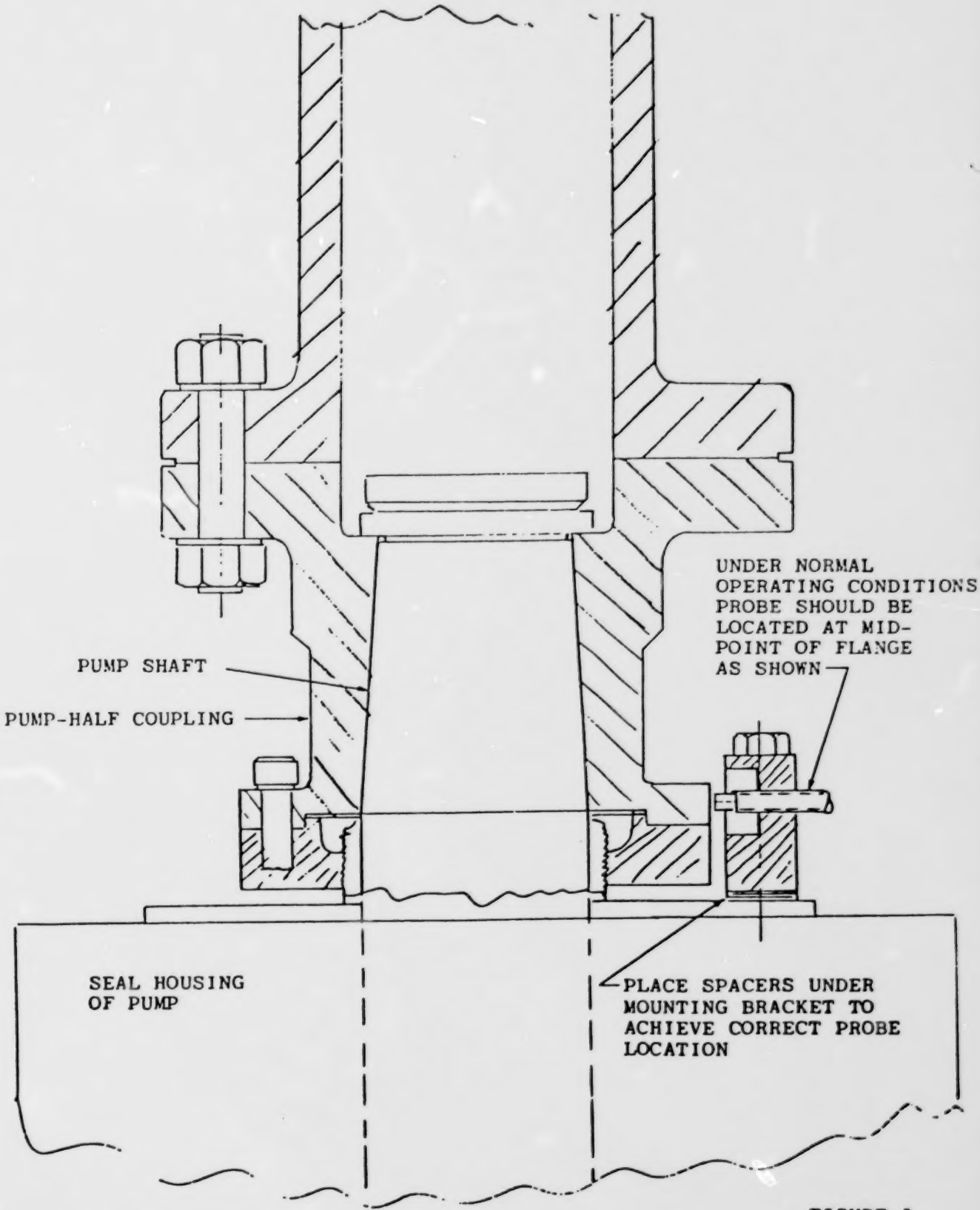
UNDER NORMAL OPERATING CONDITIONS PROBE SHOULD BE LOCATED AT MID-POINT OF FLANGE AS SHOWN
PUMP SHAFT
PUMP-HALF COUPLING
SEAL HOUSING OF PUMP
PLACE SPACERS UNDER MOUNTING BRACKET TO ACHIEVE CORRECT PROBE LOCATION

FIGURE 3

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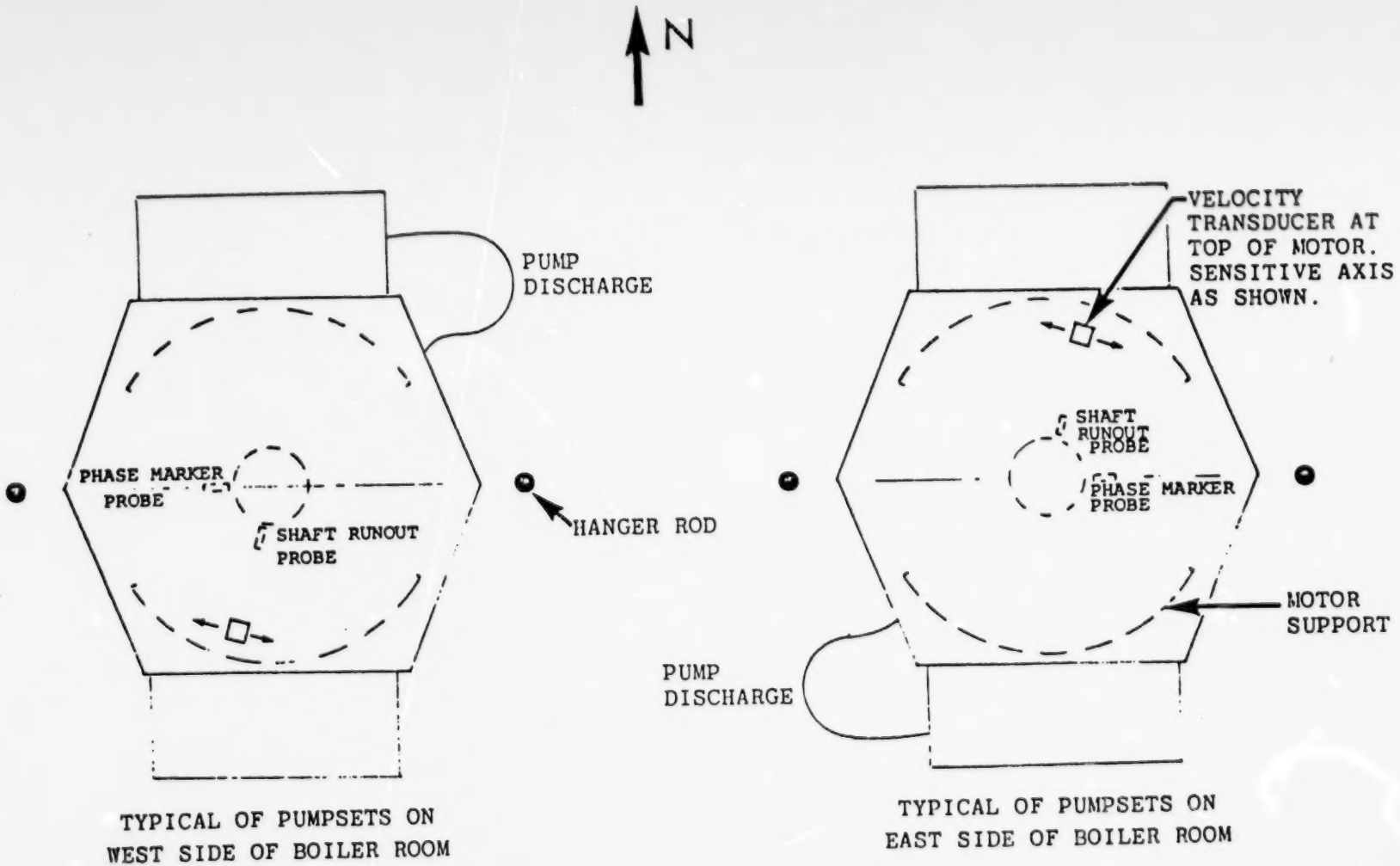
PICKERING NGS 'B' - PHT CIRCULATING PUMPSETS

ORIENTATION OF VIBRATION SENSORS



TYPICAL OF PUMPSETS ON WEST SIDE OF BOILER ROOM

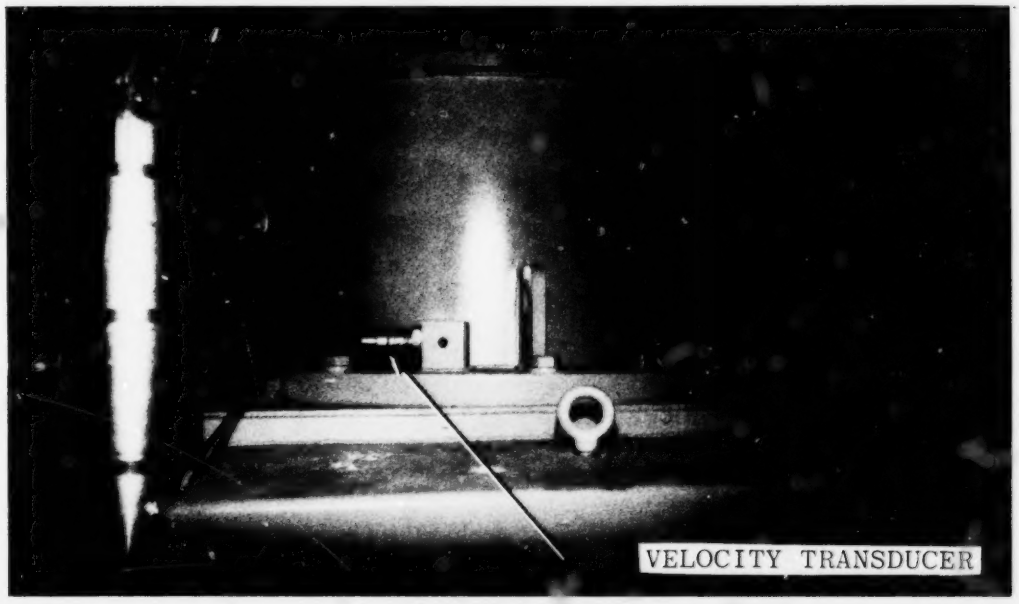
TYPICAL OF PUMPSETS ON EAST SIDE OF BOILER ROOM

FIGURE 4

171079 RD

PICKERING NGS 'B' - PHT CIRCULATING PUMPSETS

VIBRATION SENSORS



TOP OF MOTOR

PHASE
MARKER
PROBE

SHAFT
RUNOUT
PROBE

MOTOR/PUMP COUPLING

FIGURE 5

APPENDIX A

PHT PRESSURIZING PUMPSETS - COMPLIANCE TRANSFER FUNCTIONS (Impact Spectra)

Pumpset	Figure No	Direction	Frequency Range Hz
P1	A1	North - South	1-200
	A2	North - South	1-500
	A3	East - West	1-200
	A4	East - West	1-500
P2	A5	North - South	1-200
	A6	North - South	1-500
	A7	East - West	1-200
	A8	East - West	1-500

NOTE: The units on the vertical scales in the above listed Figures are N/m.

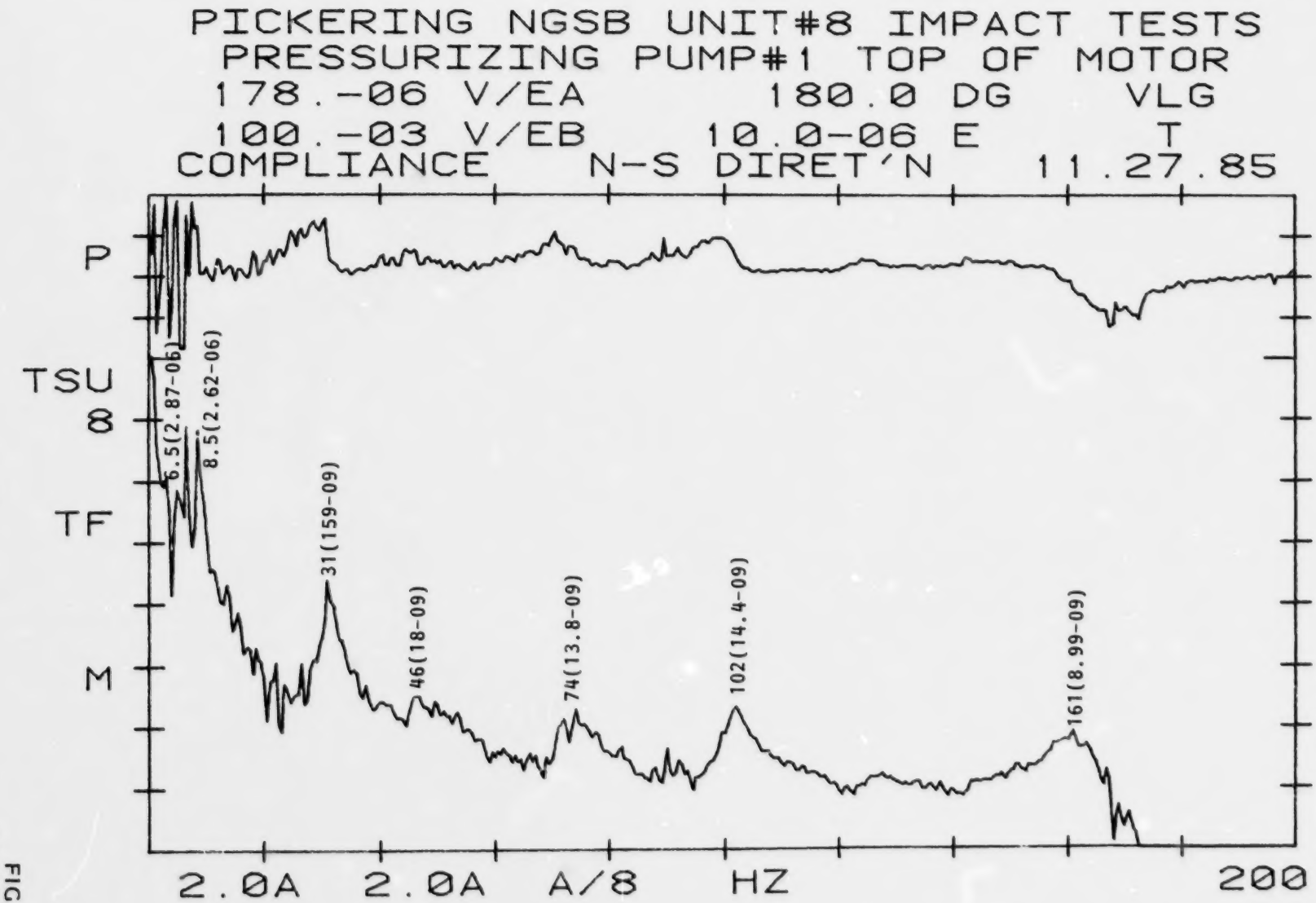

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#1 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 10.0-06 E T
COMPLIANCE N-S DIRET'N 11.27.85
P
TSU
8
TF
M
6.5(2.87-06)
8.5(2.62-06)
31(159-09)
46(18-09)
74(13.8-09)
102(14.4-09)
161(8.99-09)
2.0A 2.0A A/8 HZ 200

FIG. A1
86-311

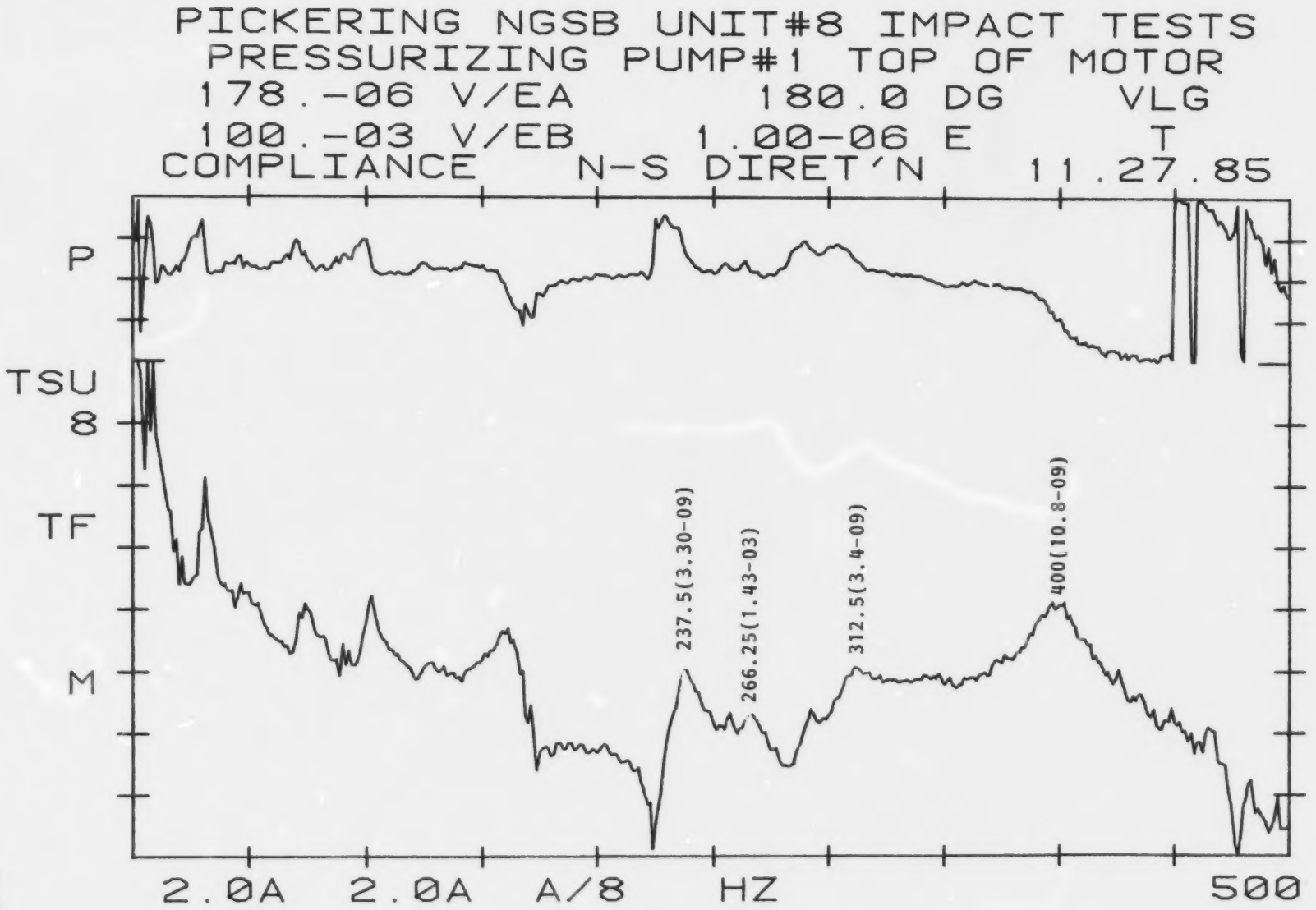

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#1 TOP OF MOTOR
178.-06 V/EA
180.0 DG
VLG
100.-03 V/EB
1.00-06 E
T
COMPLIANCE
N-S DIRET'N
11.27.85
P
TSU
8
TF
M
237.5(3.30-09)
266.25(1.43-03)
312.5(3.4-09)
400(10.8-09)
2.0A
2.0A
A/8
HZ
500

FIG. A2
86-311

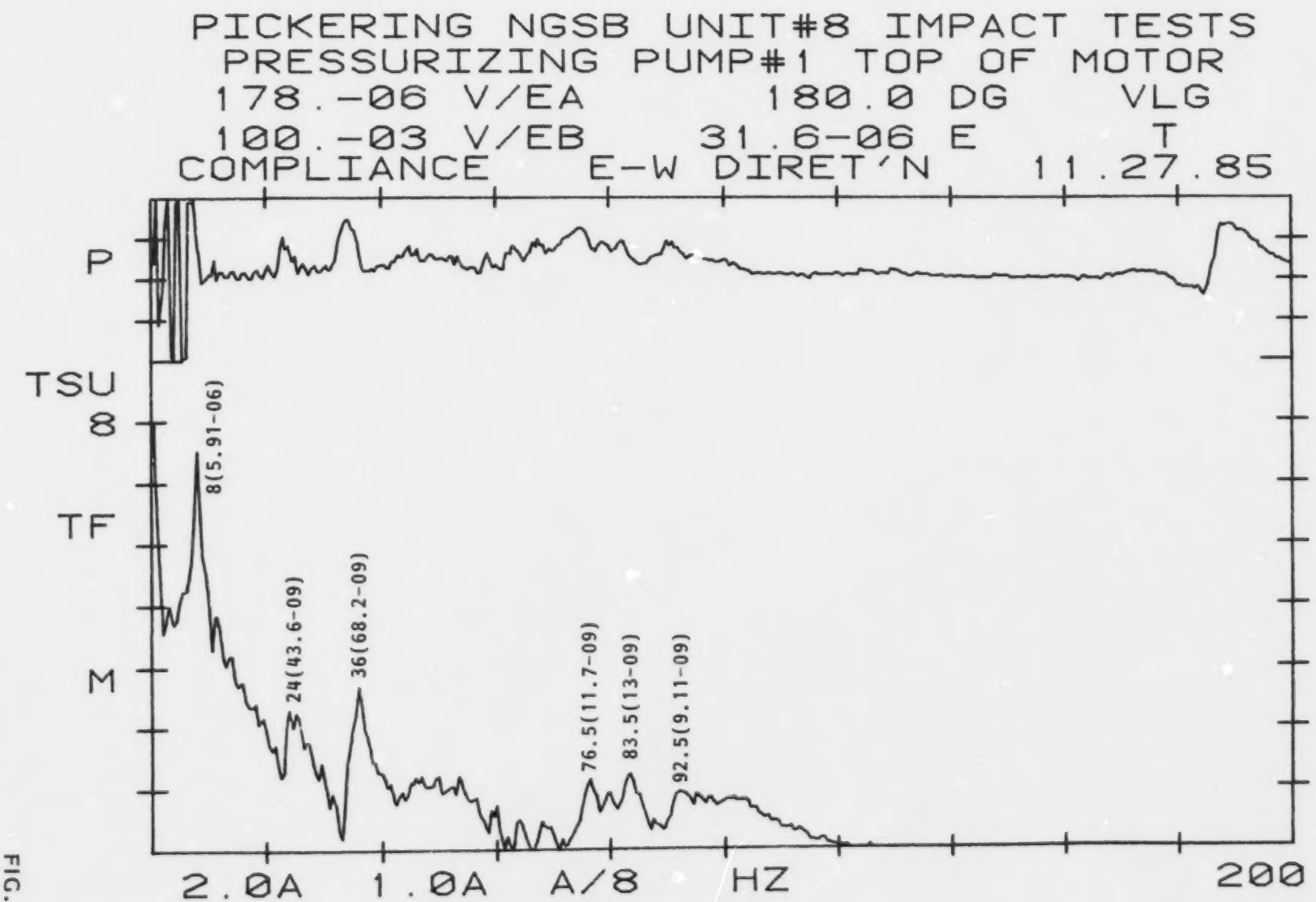

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#1 TOP OF MOTOR
178.-06 V/EA
180.0 DG
VLG
100.-03 V/EB
31.6-06 E
T
COMPLIANCE
E-W DIRET'N
11.27.85
P
TSU
8
TF
M
8(5.91-06)
24(43.6-09)
36(68.2-09)
76.5(11.7-09)
83.5(13-09)
92.5(9.11-09)
2.0A
1.0A
A/8
HZ
200

FIG. A3

86-311

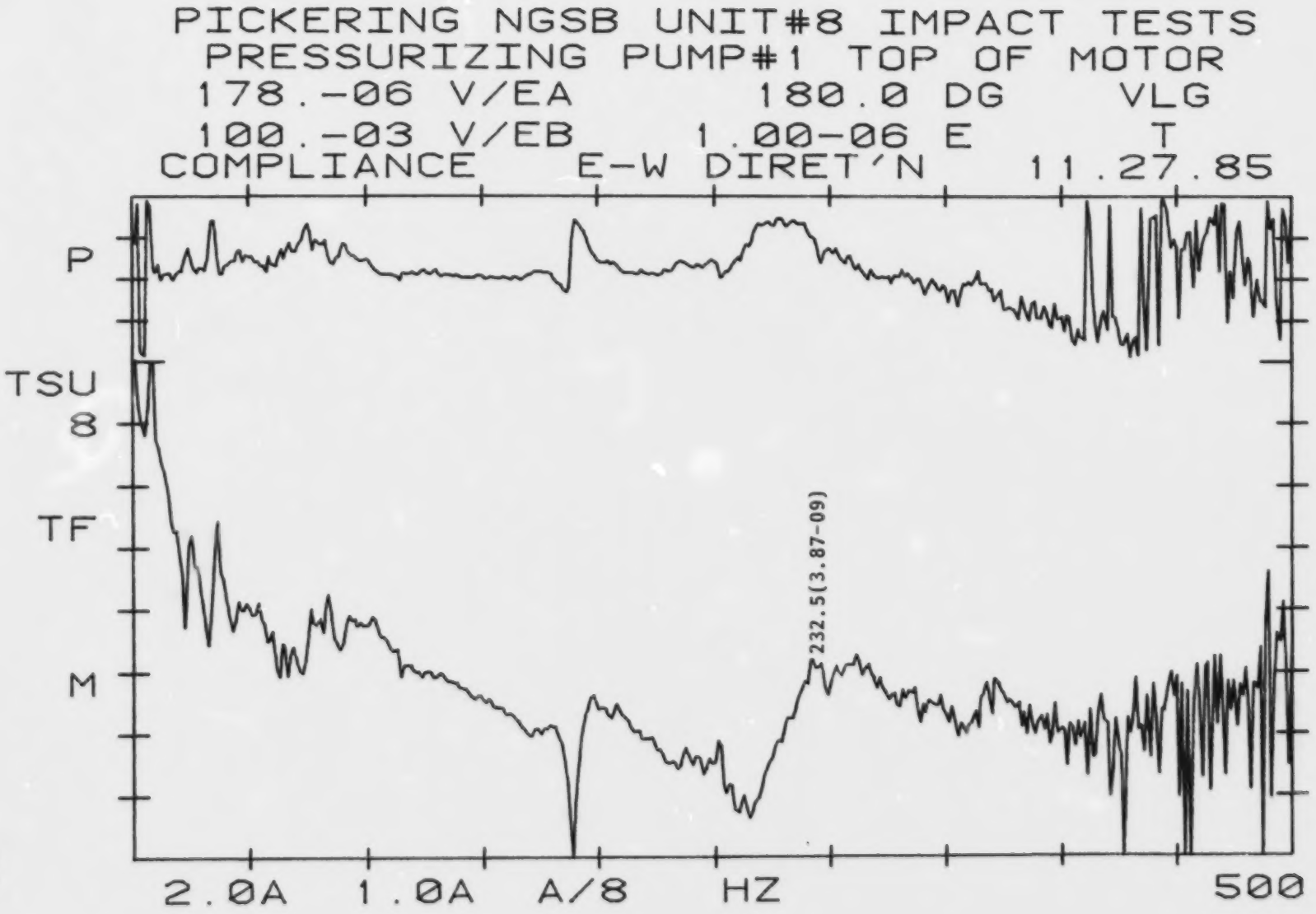

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#1 TOP OF MOTOR
178.-06 V/EA
180.0 DG
VLG
100.-03 V/EB
1.00-06 E
T
COMPLIANCE
E-W DIRET'N
11.27.85
P
TSU
8
TF
M
232.5(3.87-09)
2.0A
1.0A
A/8
HZ
500

FIG. A4

86-311

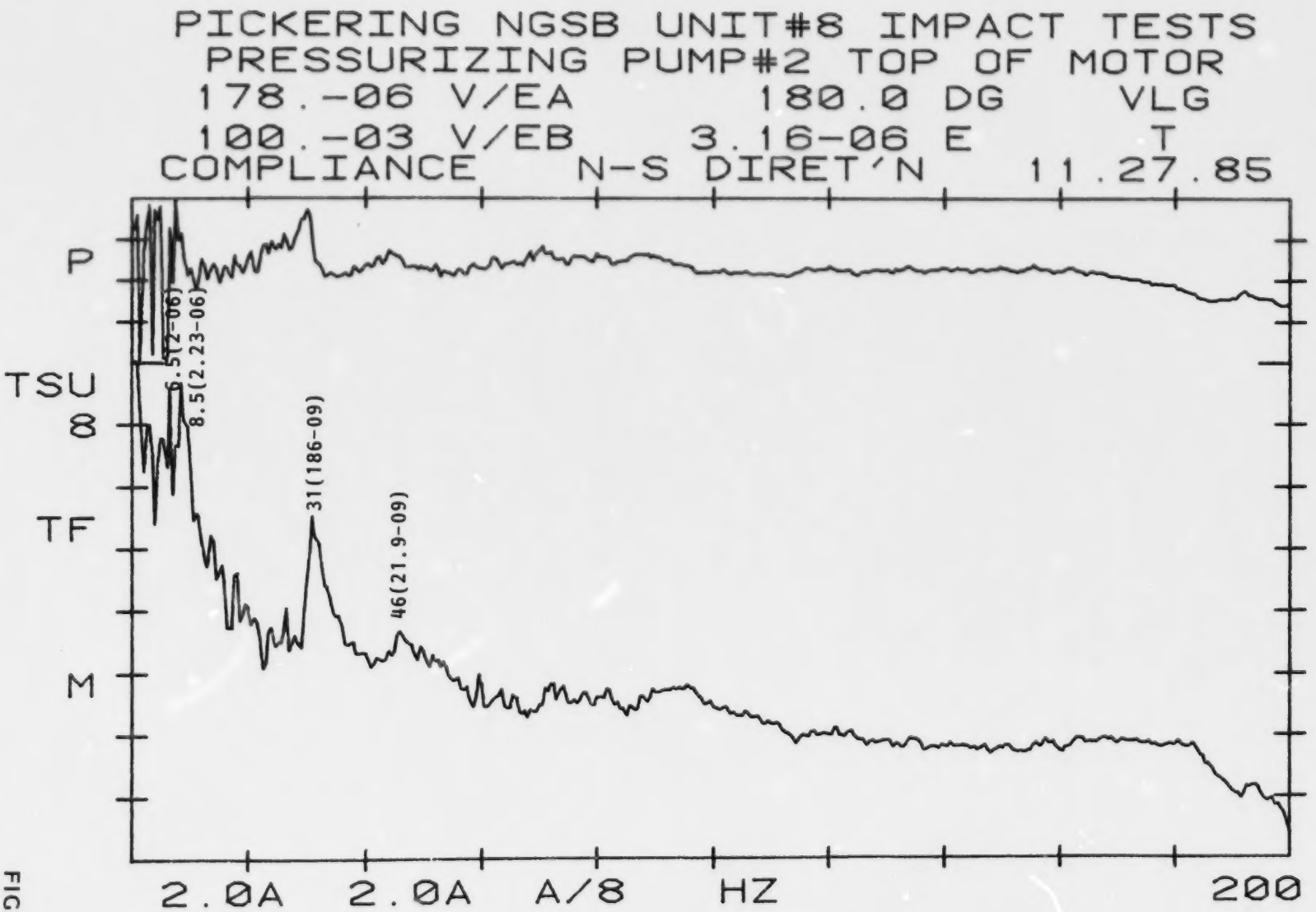

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#2 TOP OF MOTOR
178.-06 V/EA
180.0 DG
VLG
100.-03 V/EB
3.16-06 E
T
COMPLIANCE
N-S DIRET'N
11.27.85
P
TSU
8
TF
M
6.5(2-06)
8.5(2.23-06)
31(186-09)
46(21.9-09)
2.0A
2.0A
A/8
HZ
200

FIG. A5

86-311

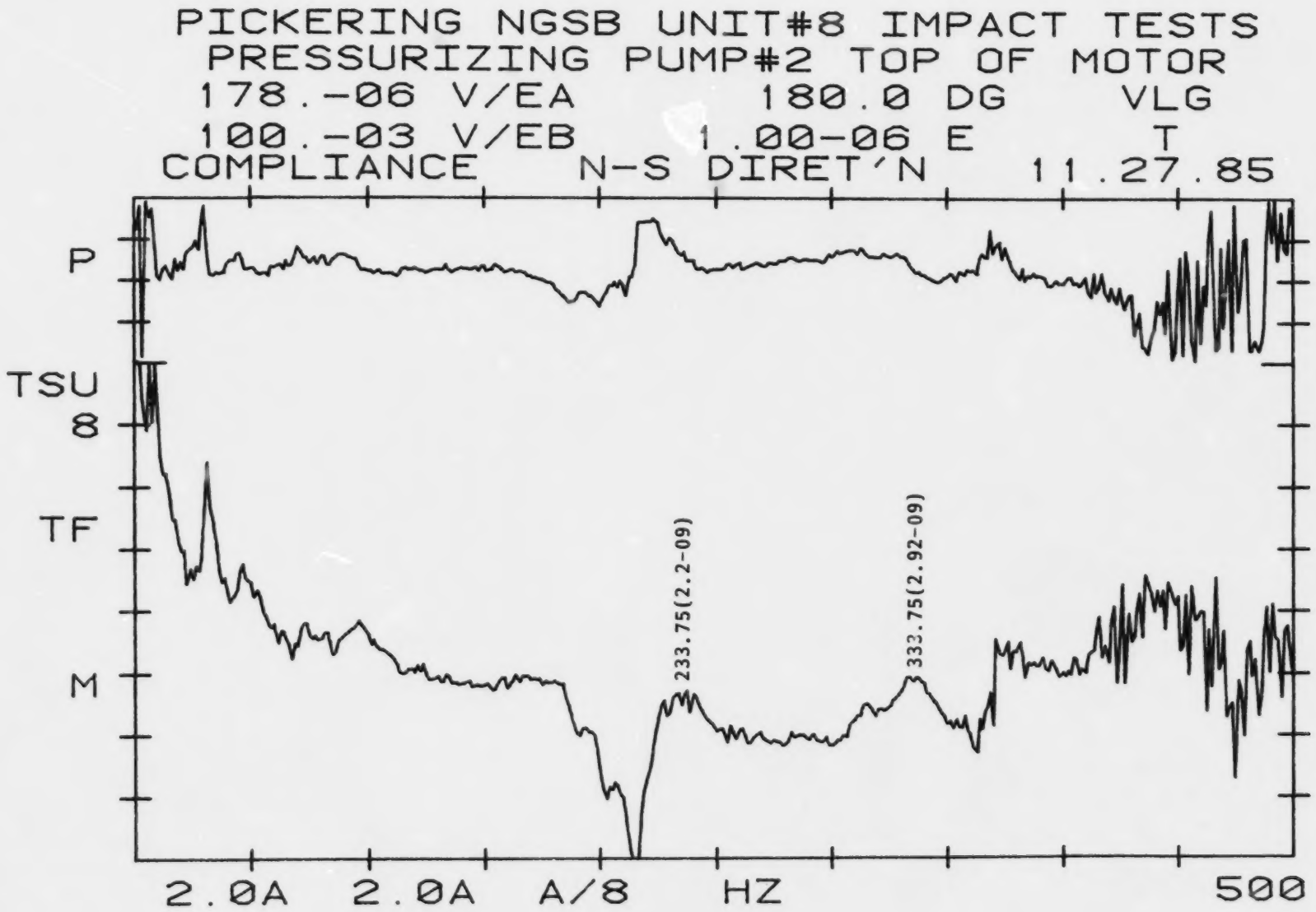

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#2 TOP OF MOTOR
178.-06 V/EA
180.0 DG
VLG
100.-03 V/EB
1.00-06 E
T
COMPLIANCE
N-S DIRET'N
11.27.85
P
TSU
8
TF
M
233.75(2.2-09)
333.75(2.92-09)
2.0A
2.0A
A/8
HZ
500

FIG. A6 86-311

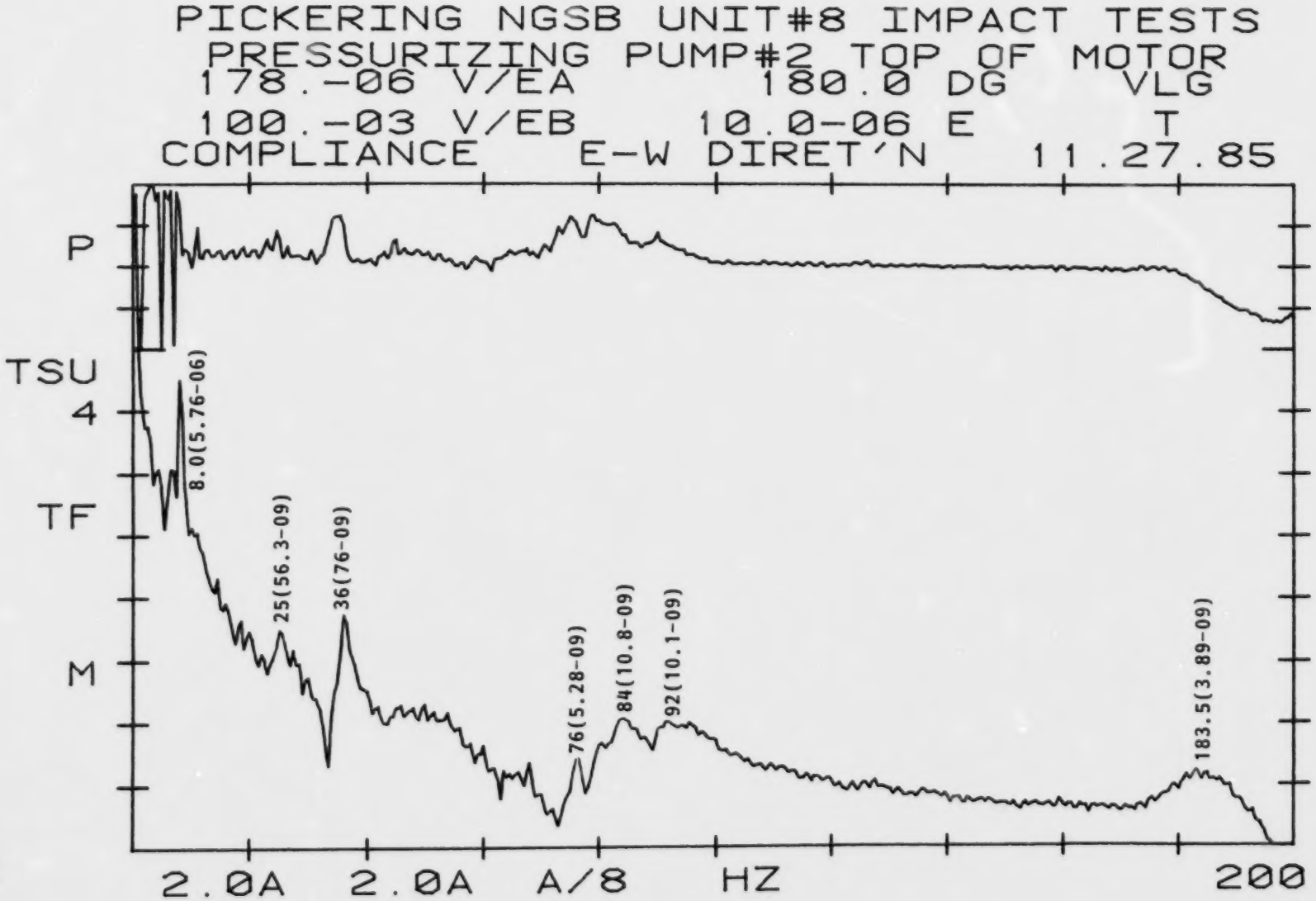

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#2 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 10.0-06 E T
COMPLIANCE E-W DIRET'N 11.27.85
P
TSU
4
TF
M
8.0(5.76-06)
25(56.3-09)
36(76-09)
76(5.28-09)
84(10.8-09)
92(10.1-09)
183.5(3.89-09)
2.0A 2.0A A/8 HZ 200

FIG. A7
86-3Ii

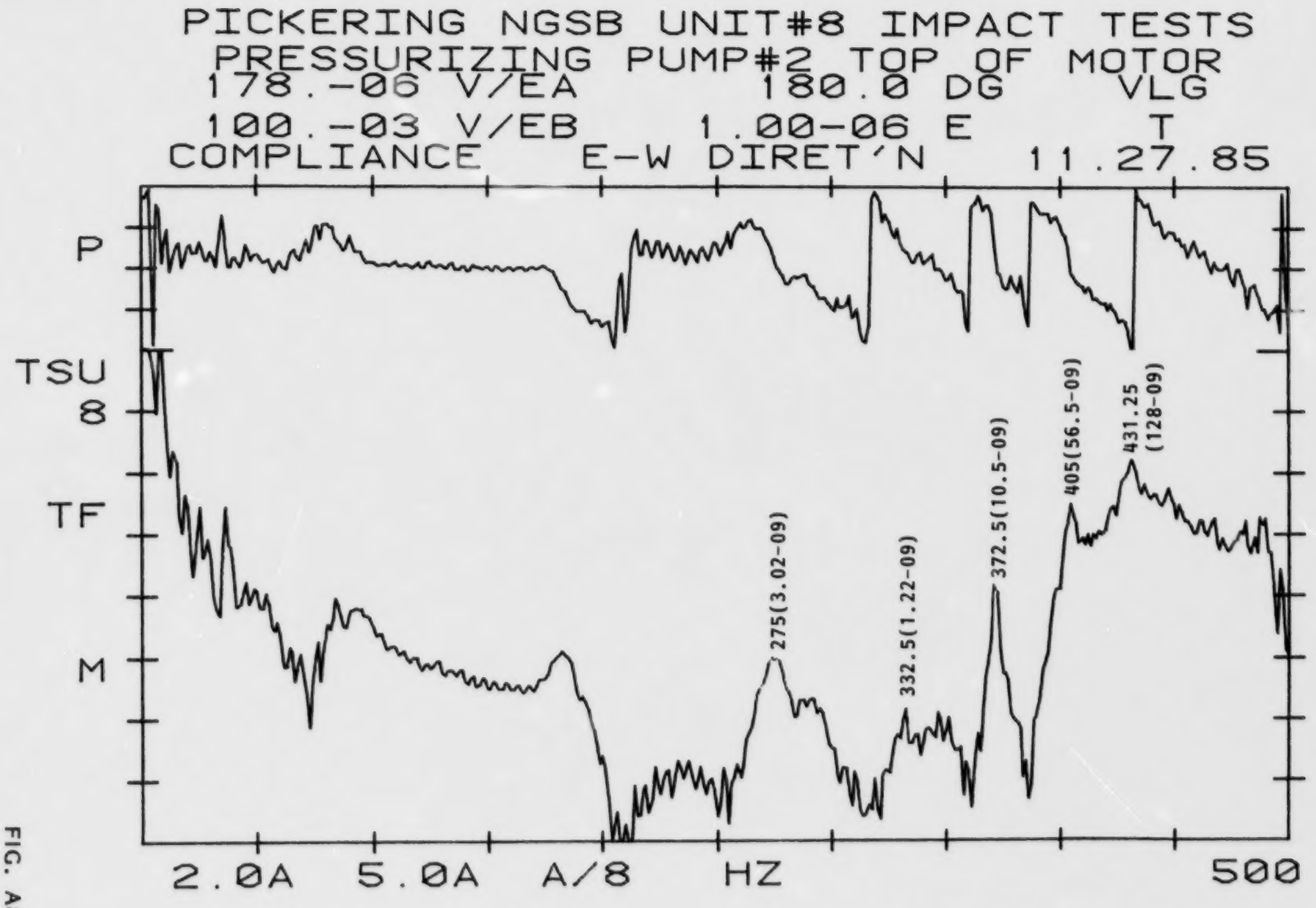

PICKERING NGSB UNIT#8 IMPACT TESTS
PRESSURIZING PUMP#2 TOP OF MOTOR
178.-06 V/EA
180.0 DG
VLG
100.-03 V/EB
1.00-06 E
T
COMPLIANCE
E-W DIRET'N
11.27.85
P
TSU
8
TF
M
275(3.02-09)
332.5(1.22-09)
372.5(10.5-09)
405(56.5-09)
431.25
(128-09)
2.0A
5.0A
A/8
HZ
500

FIG. A8

86-311

APPENDIX B

PHT CIRCULATING PUMPSETS - COMPLIANCE TRANSFER FUNCTIONS
(Impact Spectra)

Pumpset	Figure No	Direction	Frequency Range Hz
P1	B1	North - South	1-200
	B2	North - South	1-500
	B3	East - West	1-200
	B4	East - West	1-500
P2	B5	North - South	1-200
	B6	East - West	1-200
P3	B7	North - South	1-200
	B8	East - West	1-200
P4	B9	North - South	1-200
	B10	East - West	1-200
P5	B11	North - South	1-200
	B12	East - West	1-200
P6	B13	North - South	1-200
	B14	North - South	1-500
	B15	East - West	1-200
	B16	East - West	1-500
P7	B17	North - South	1-200
	B18	East - West	1-200
P8	B19	North - South	1-200
	B20	East - West	1-200
P9	B21	North - South	1-200
	B22	East - West	1-200
P10	B23	North - South	1-200
	B24	East - West	1-200
P11	B25	North - South	1-200
	B26	East - West	1-200
P12	B27	North - South	1-200
	B28	North - South	1-500
	B29	East - West	1-200
	B30	East - West	1-500
P13	B31	North - South	1-200
	B32	East - West	1-200
P14	B33	North - South	1-200
	B34	East - West	1-200
P15	B35	North - South	1-200
	B36	North - South	1-500
	B37	East - West	1-200
	B38	East - West	1-500
P16	B39	North - South	1-200
	B40	East - West	1-200
	B41	East - West	1-200
	B42	East - West Coherence	1-200

Note: The units on the vertical scales in Figures listed above are N/m.

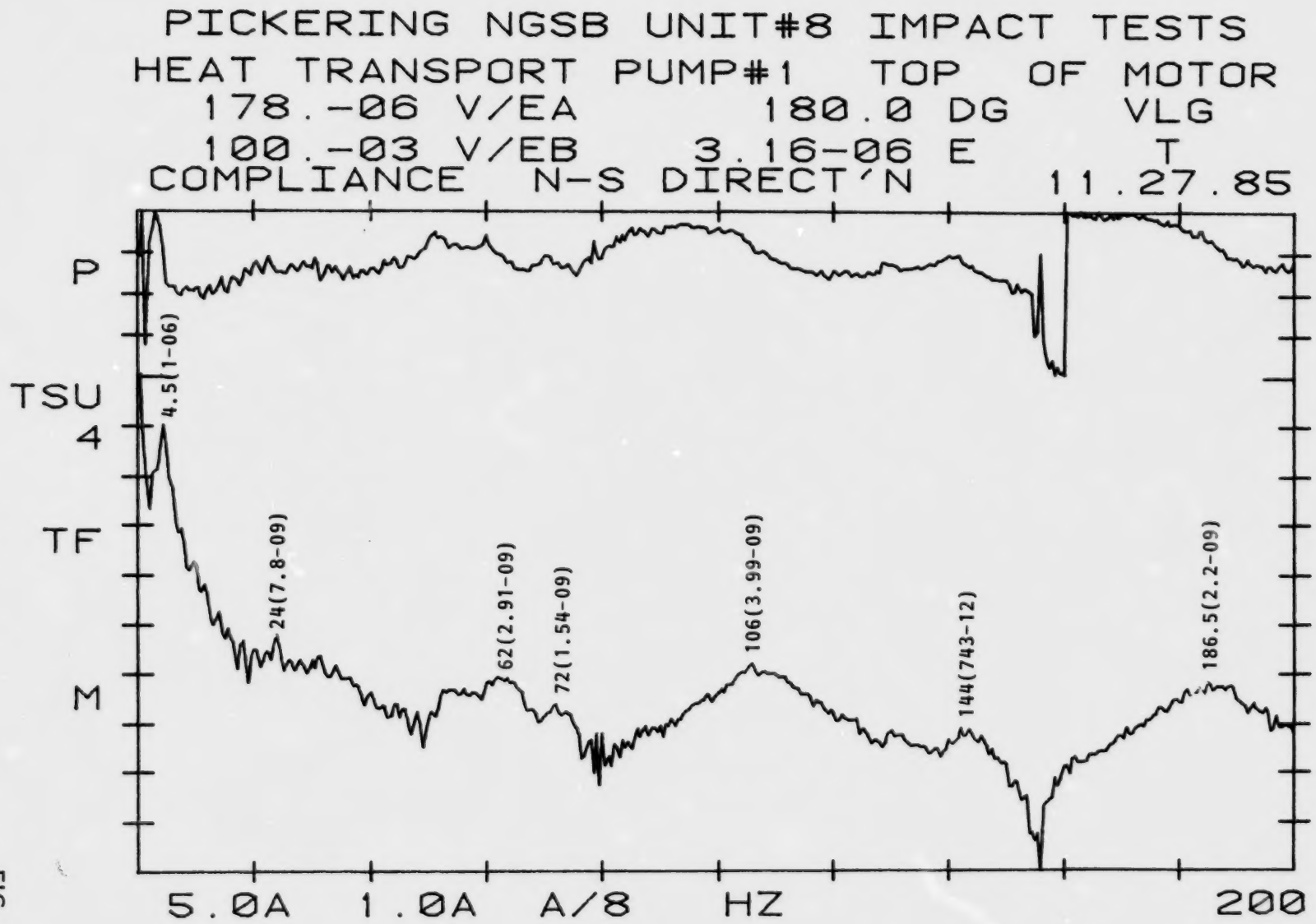

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#1 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE N-S DIRECT'N 11.27.85
P
TSU
4
TF
M
4.5(1-06)
24(7.8-09)
62(2.91-09)
72(1.54-09)
106(3.99-09)
144(743-12)
186.5(2.2-09)
5.0A
1.0A
A/8
HZ
200

FIG. B1 86-311

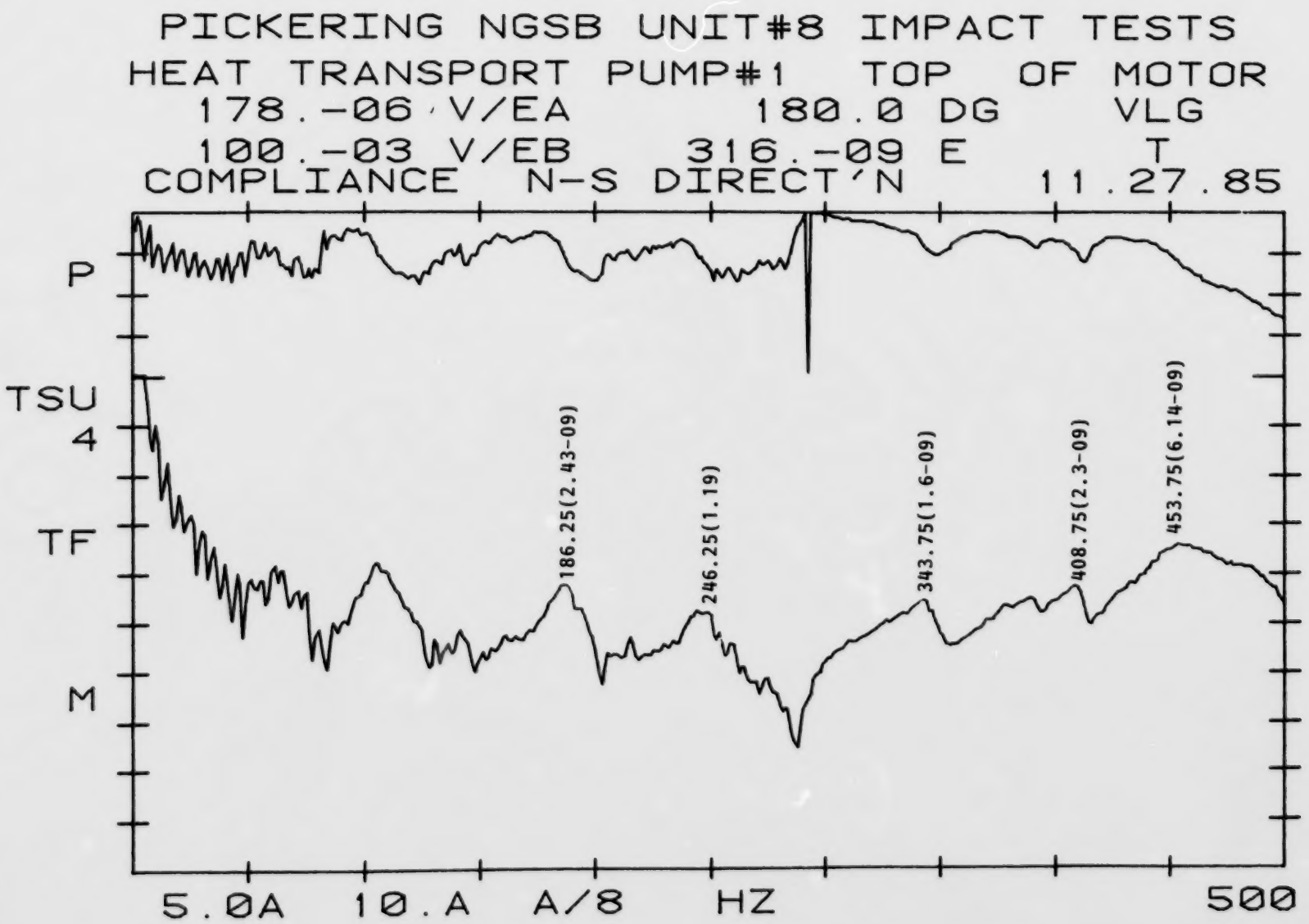

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#1 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 316.-09 E T
COMPLIANCE N-S DIRECT'N 11.27.85
P
TSU
4
TF
M
186.25(2.43-09)
246.25(1.19)
343.75(1.6-09)
408.75(2.3-09)
453.75(6.14-09)
5.0A
10.A
A/8
HZ
500

FIG. B2
86-311

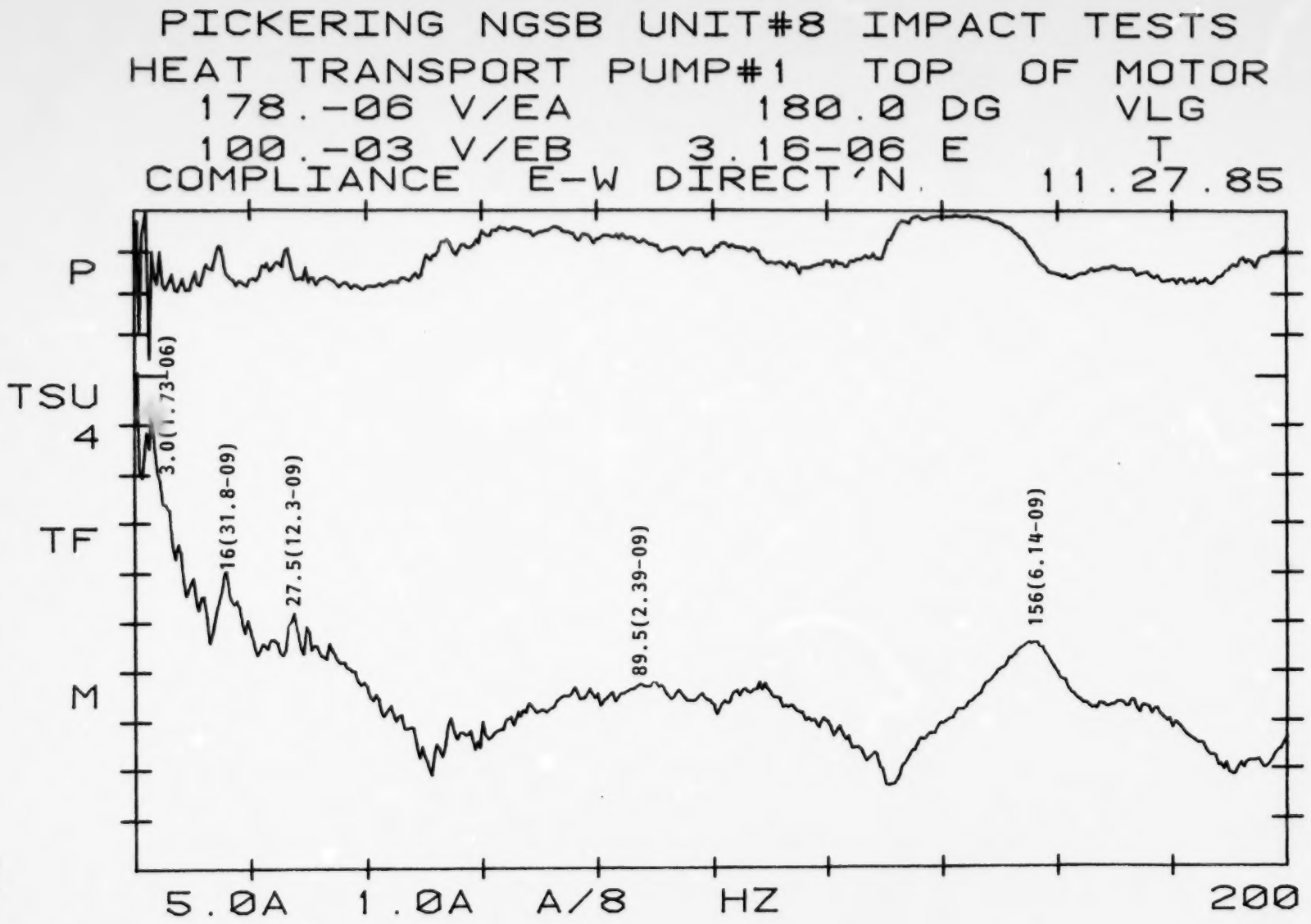

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#1 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N. 11.27.85
P
TSU
4
TF
M
3.0(1.73-06)
16(31.8-09)
27.5(12.3-09)
89.5(2.39-09)
156(6.14-09)
5.0A
1.0A
A/8
HZ
200

FIG. B3
86-311

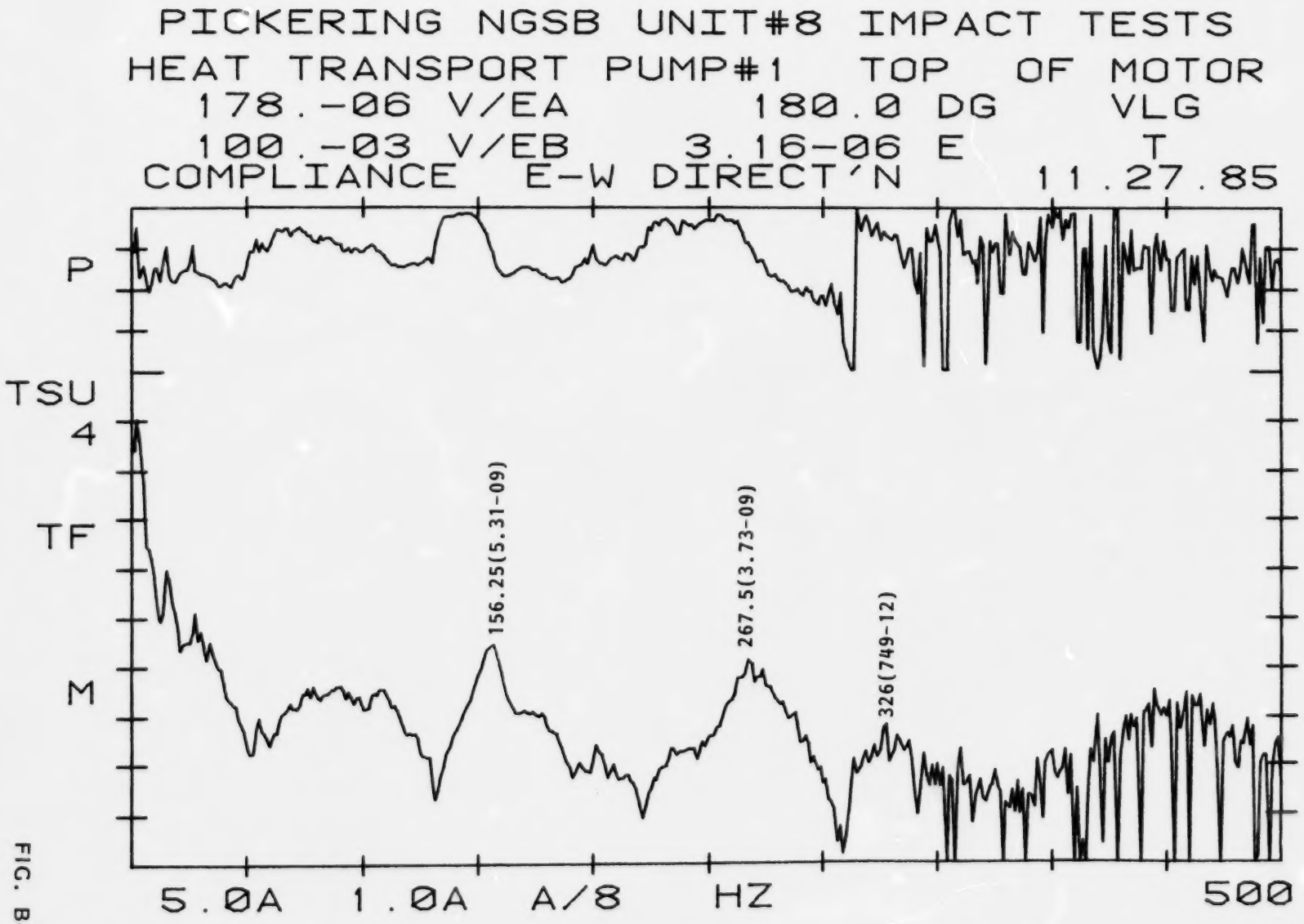

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#1 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU
4
TF
M
156.25(5.31-09)
267.5(3.73-09)
326(749-12)
5.0A 1.0A A/8 HZ 500

FIG. B4

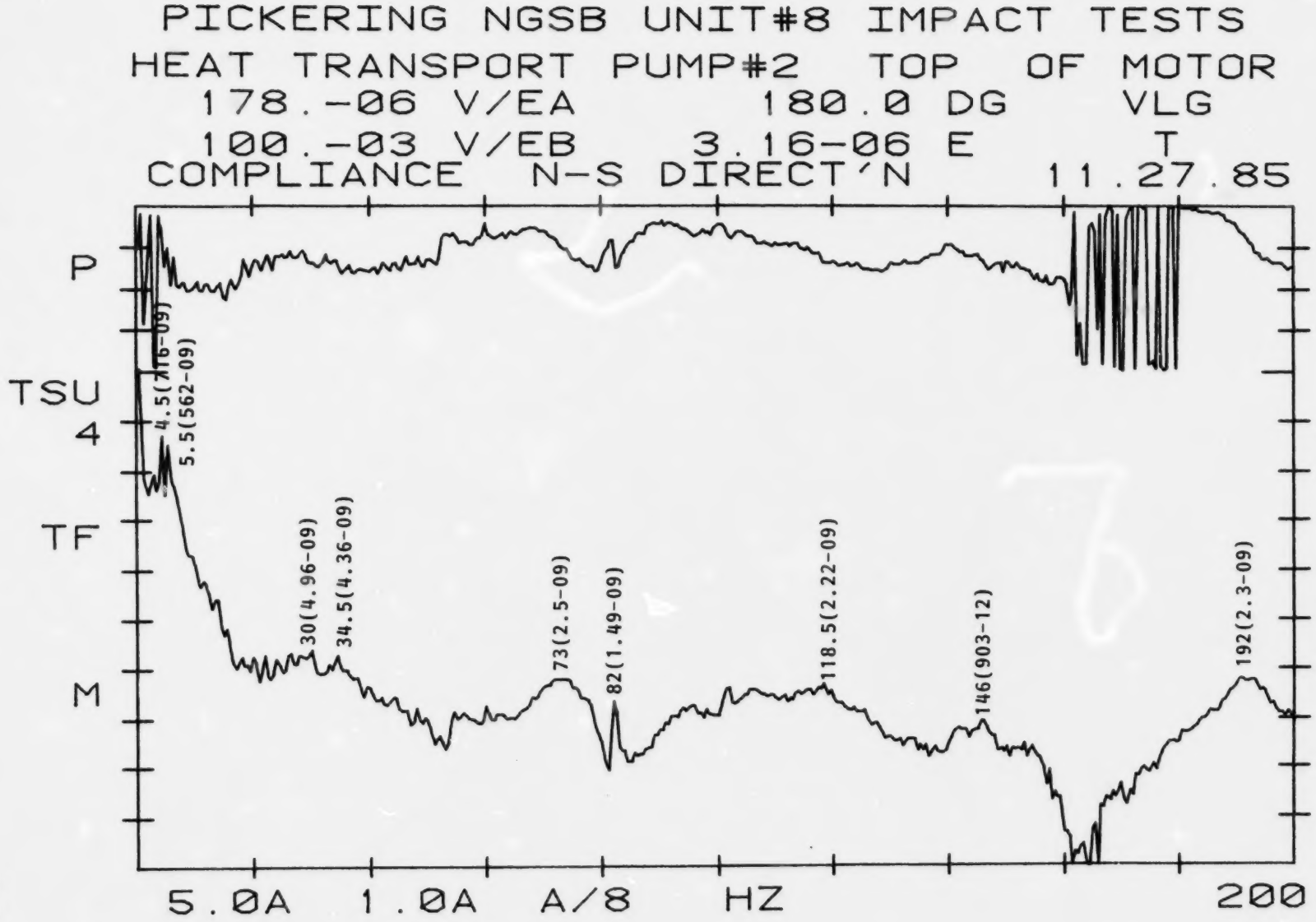

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#2 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE N-S DIRECT'N 11.27.85
P
TSU
4
TF
M
4.5(716-09)
5.5(562-09)
30(4.96-09)
34.5(4.36-09)
73(2.5-09)
82(1.49-09)
118.5(2.22-09)
146(903-12)
192(2.3-09)
5.0A
1.0A
A/8
HZ
200

FIG. B5
86-311

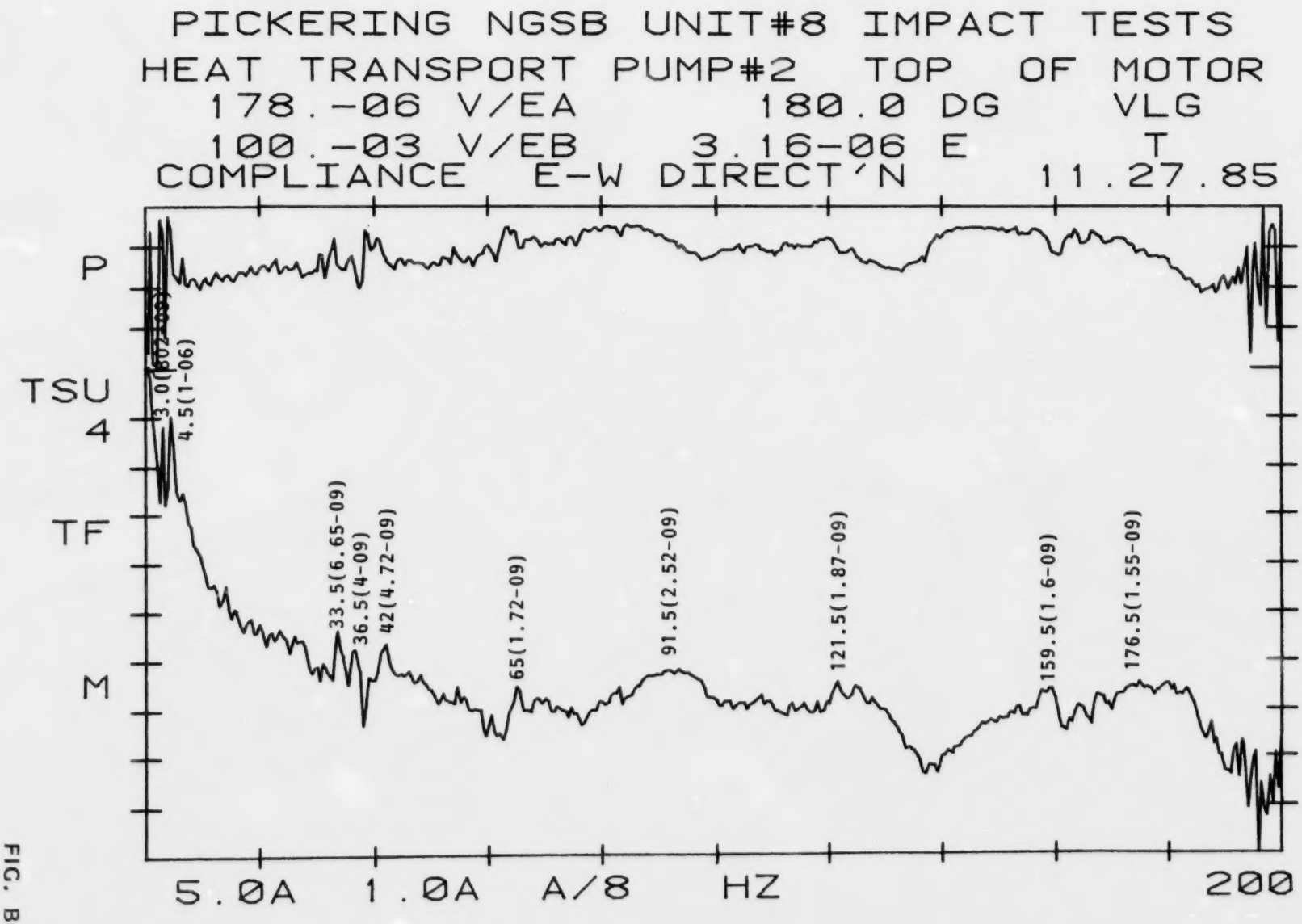

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#2 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU
4
TF
M
3.0(6.07-08)
4.5(1-06)
33.5(6.65-09)
36.5(4-09)
42(4.72-09)
65(1.72-09)
91.5(2.52-09)
121.5(1.87-09)
159.5(1.6-09)
176.5(1.55-09)
5.0A
1.0A
A/8
HZ
200

FIG. B6
86-311

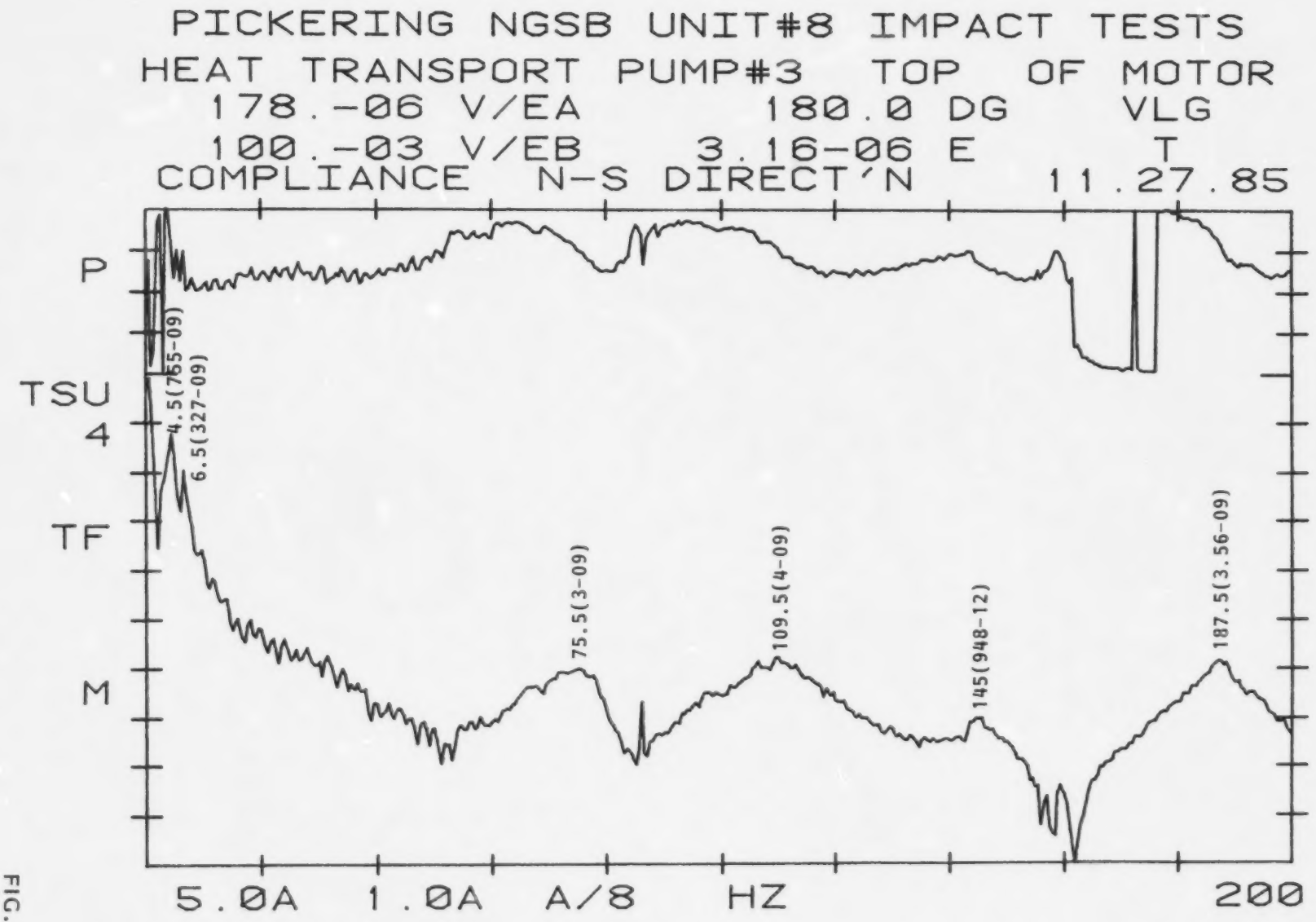

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#3 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE N-S DIRECT'N 11.27.85
P
TSU
4
TF
M
4.5(765-09)
6.5(327-09)
75.5(3-09)
109.5(4-09)
145(948-12)
187.5(3.56-09)
5.0A 1.0A A/8 HZ 200

FIG. 87
86-311

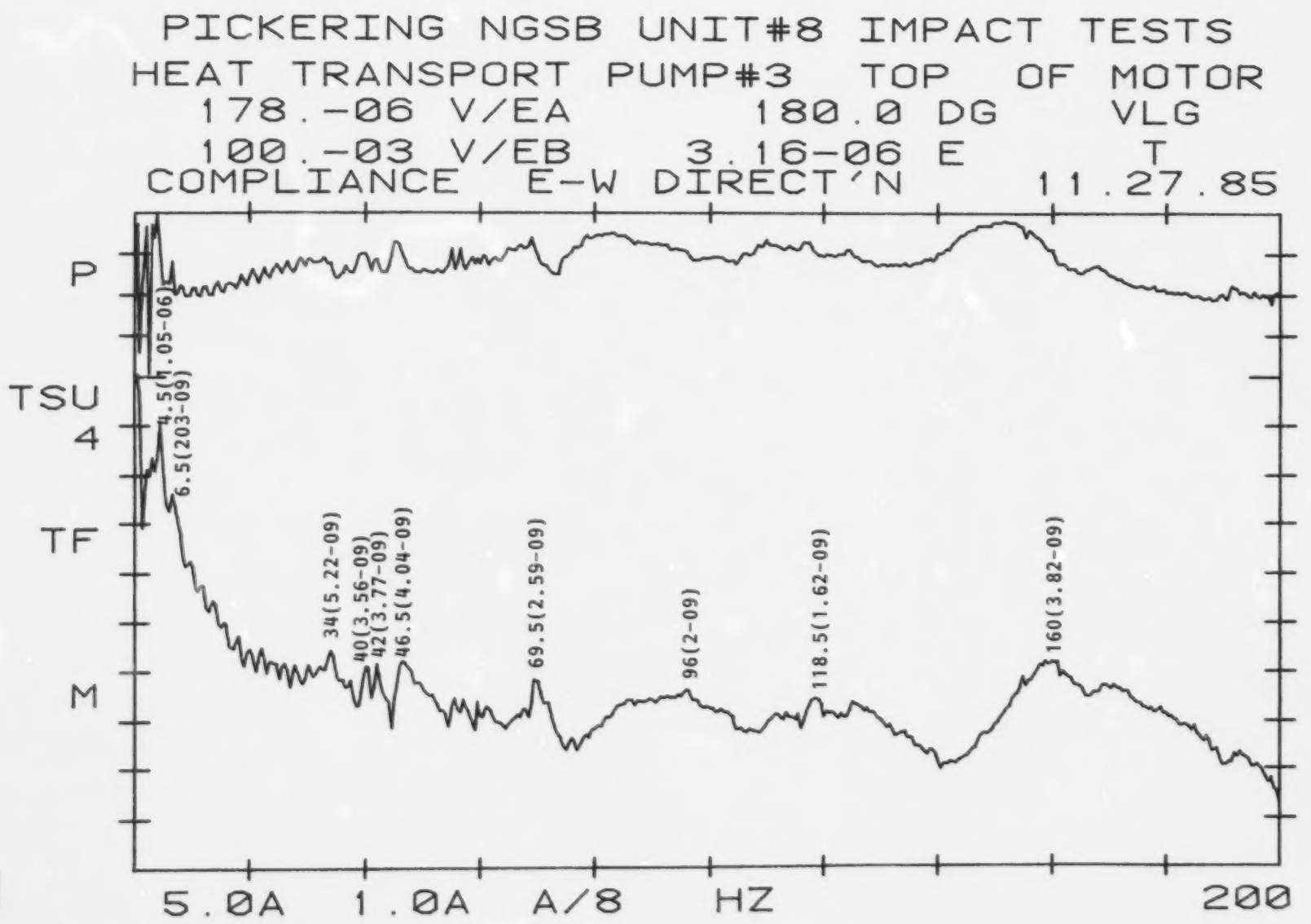

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#3 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU
4
TF
M
4.5(1.05-06)
6.5(203-09)
34(5.22-09)
40(3.56-09)
42(3.77-09)
46.5(4.04-09)
69.5(2.59-09)
96(2-09)
118.5(1.62-09)
160(3.82-09)
5.0A
1.0A
A/8
HZ
200

FIG. B8
86-311

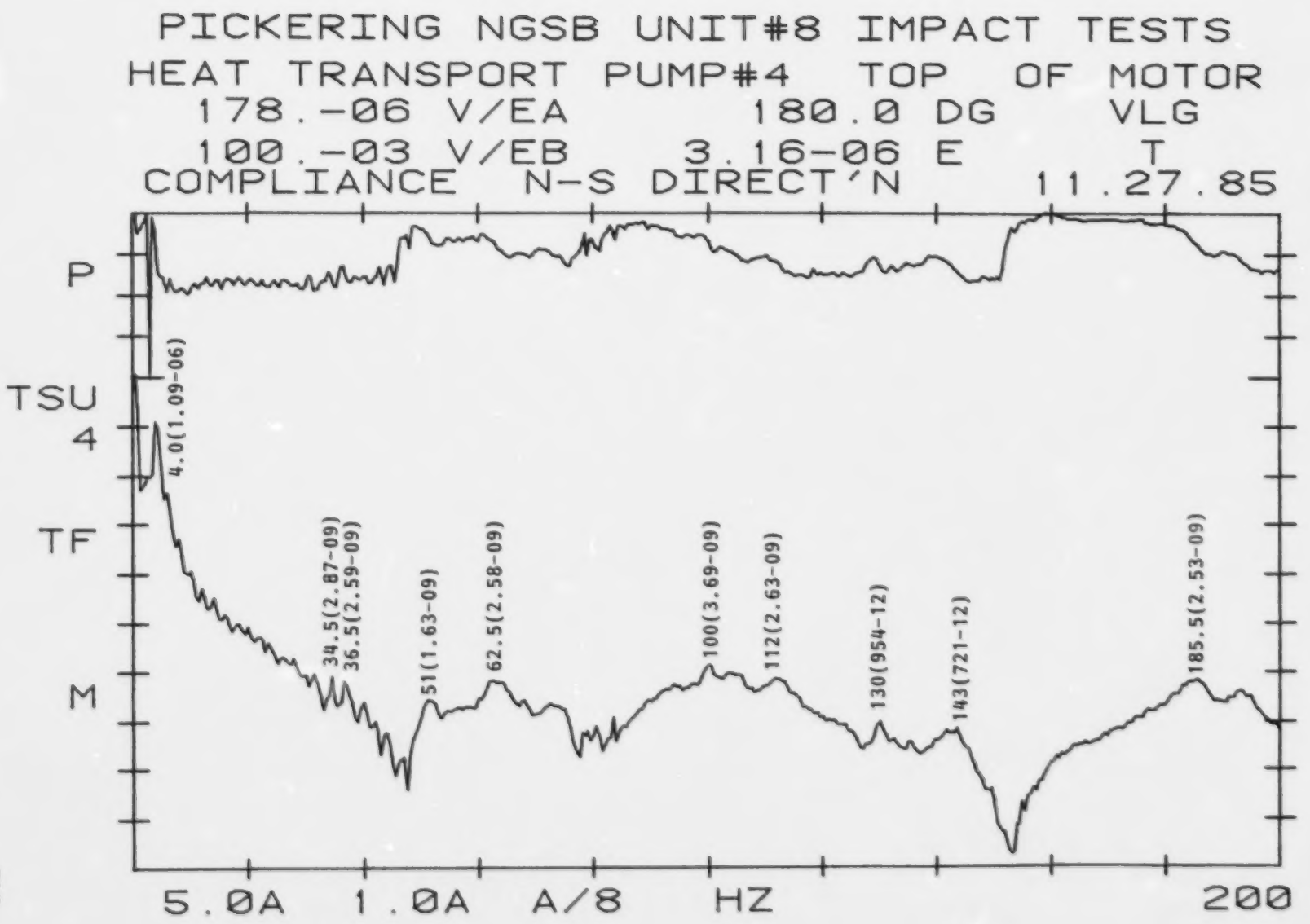

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#4 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE N-S DIRECT'N 11.27.85
P
TSU
4
TF
M
4.0(1.09-06)
34.5(2.87-09)
36.5(2.59-09)
51(1.63-09)
62.5(2.58-09)
100(3.69-09)
112(2.63-09)
130(954-12)
143(721-12)
185.5(2.53-09)
5.0A
1.0A
A/8
HZ
200

FIG. B9
86-311

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#4 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU 4
TF
M
5.0A 1.0A A/8 HZ
200
3.5(2.07-06)
20.5(10.7-09)
29.5(10.5-09)
36(10.9-09)
43.5(2.65-09)
56(1.26-09)
70(2.19-09)
90(2.39-09)
114.5(1.34-09)
159.5(5.17-09)

FIG. B10

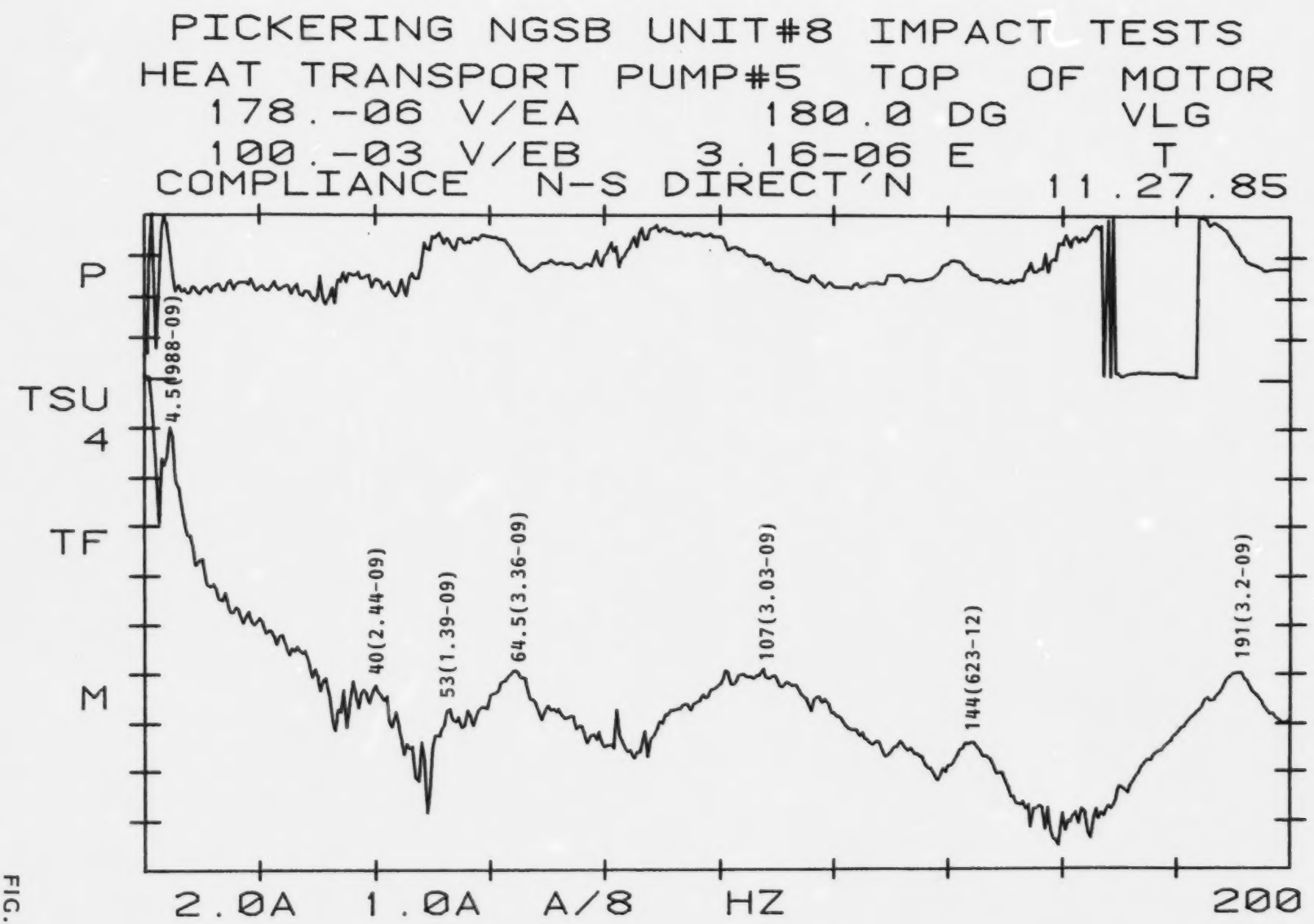


FIG. B11
86-311

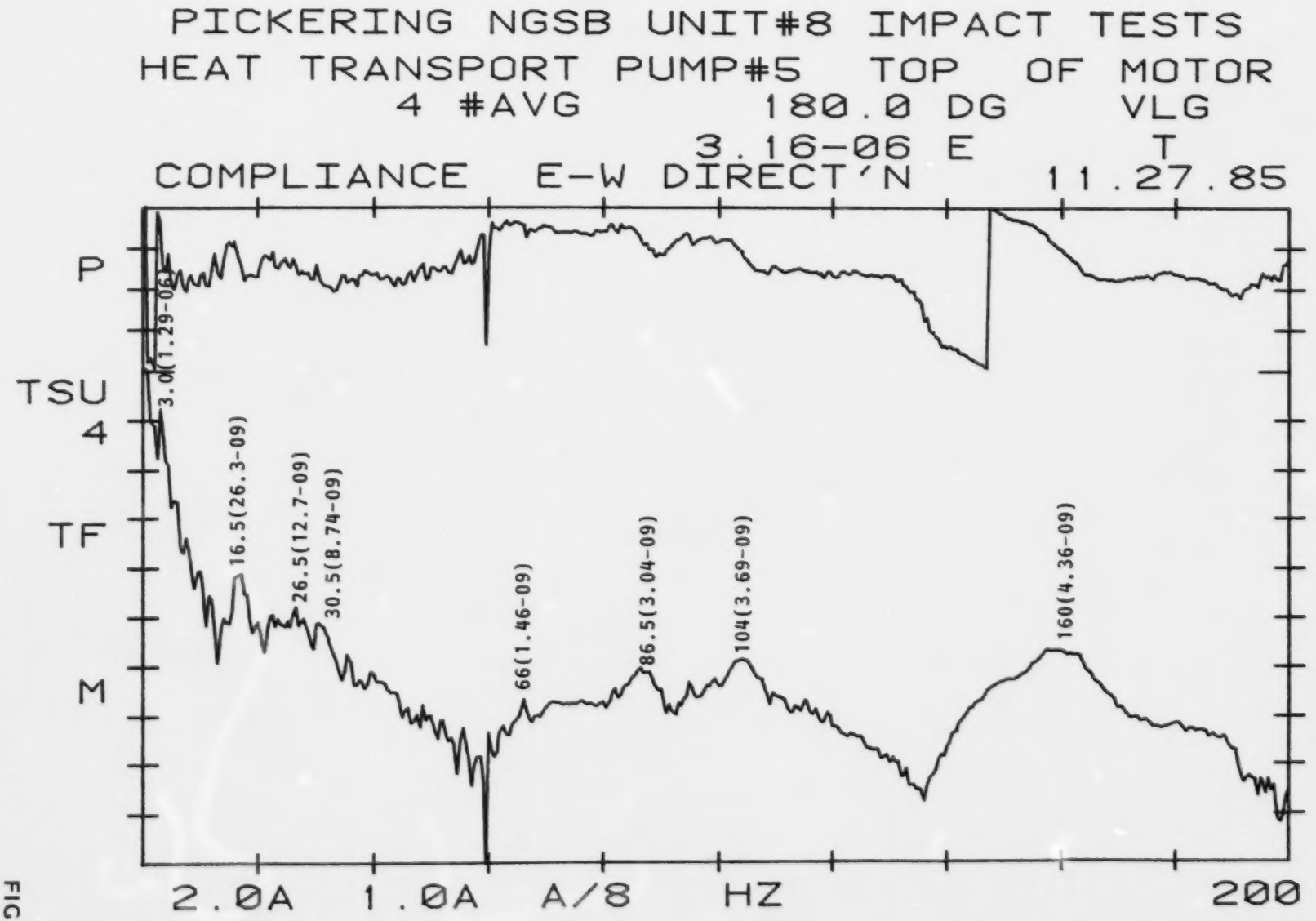


FIG. B12

86-311

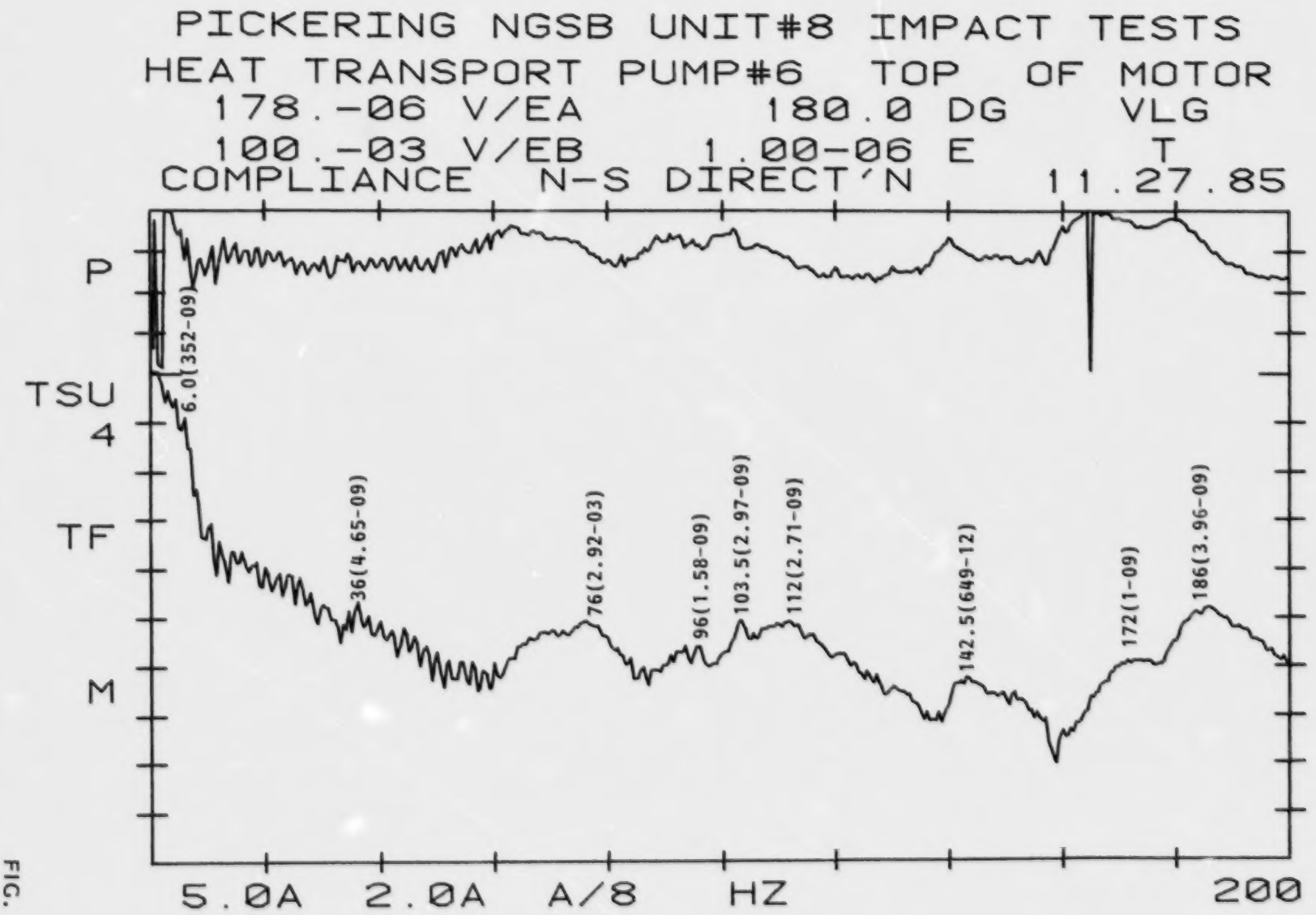


FIG. B13
86-311

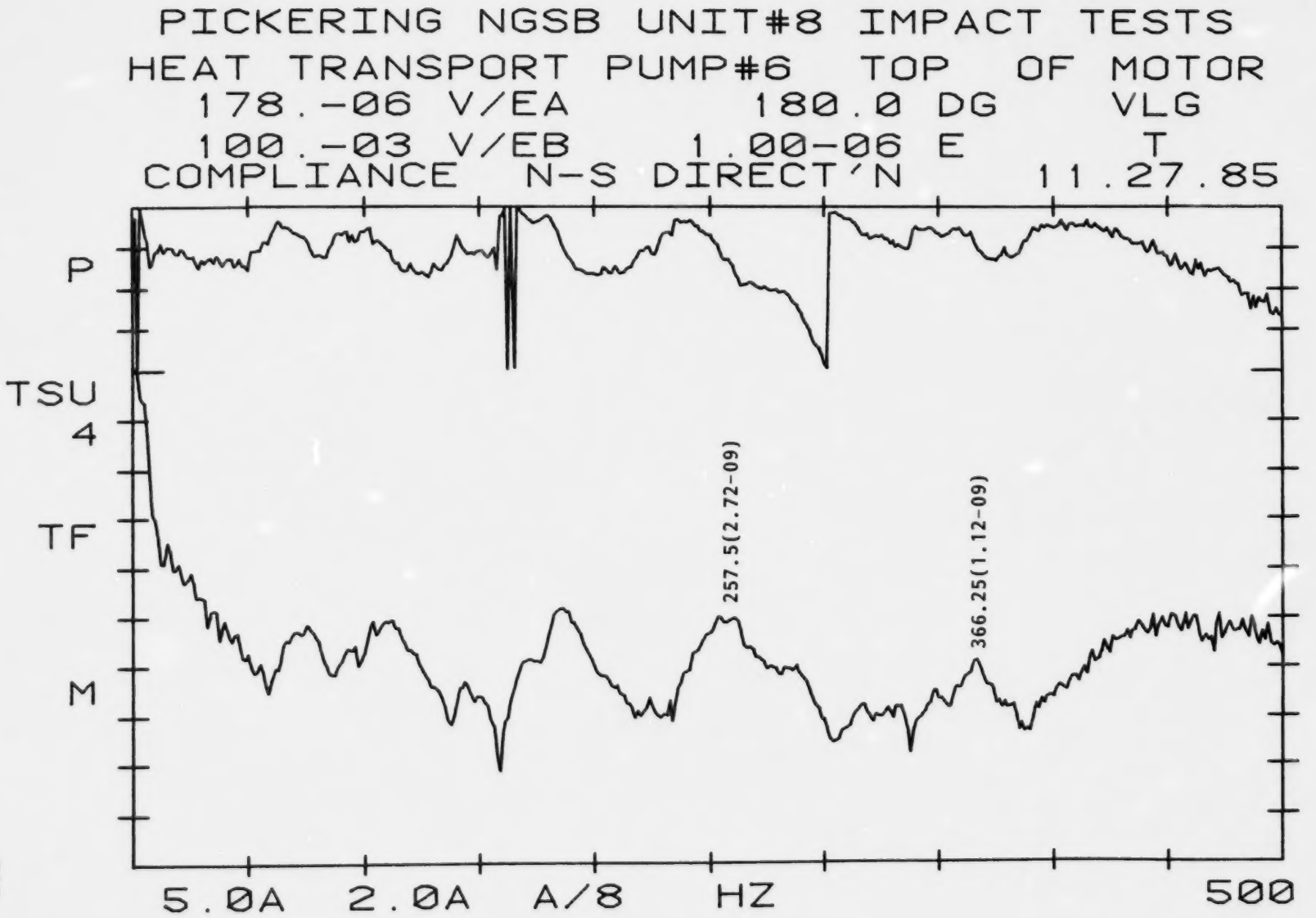


FIG. B14

86-311

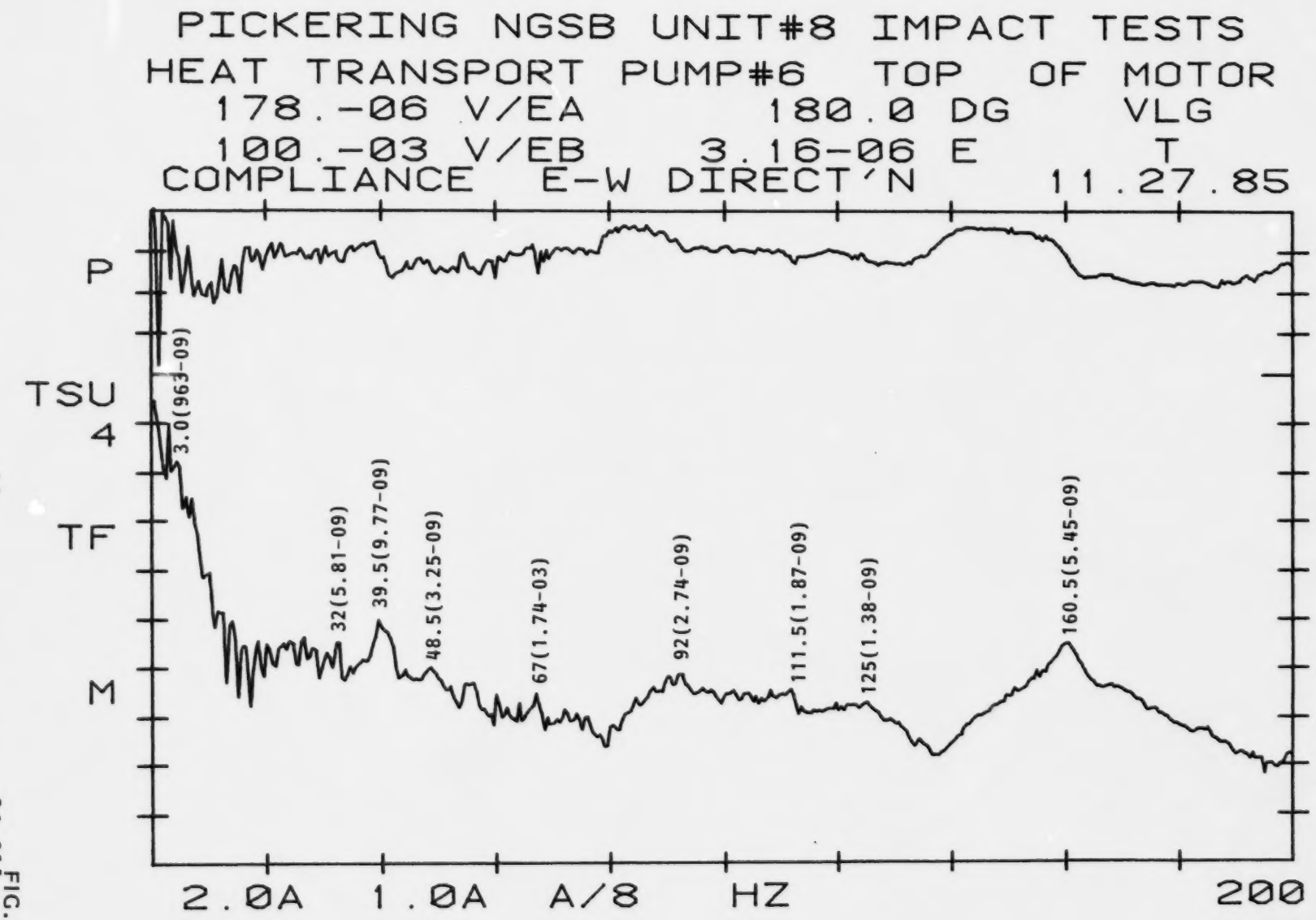


FIG. B15
89-311

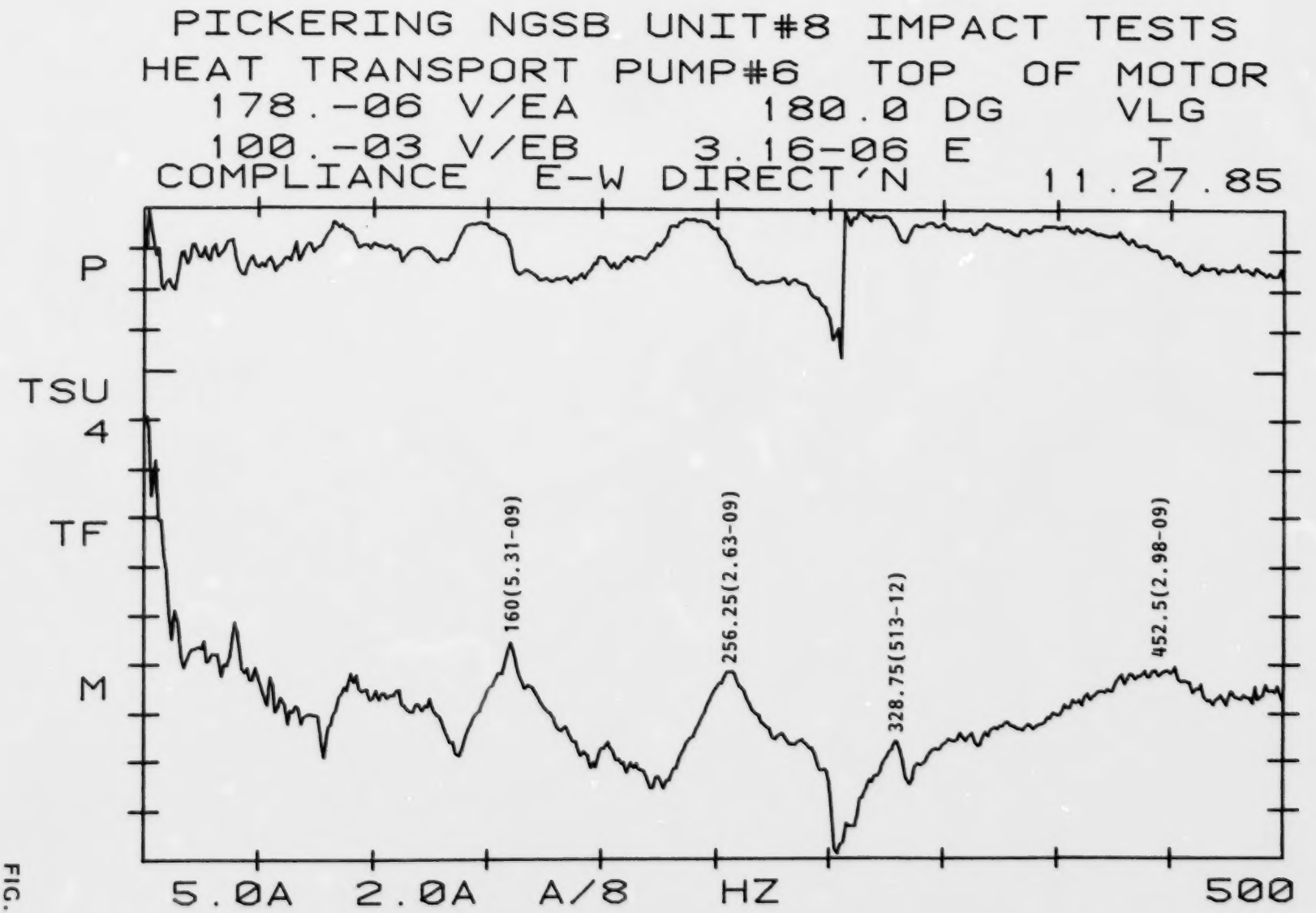


FIG. B16

86-311

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#7 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE N-S DIRECT'N 11.27.85
P
TSU 4
TF
M
415(632-09)
31.5(4.01-09)
74.5(4.18-09)
98(2.15-03)
110(3.49-09)
130(1.5-09)
144.5(871-12)
187(4.61-09)
5.0A 2.0A A/8 HZ
200

FIG. B17

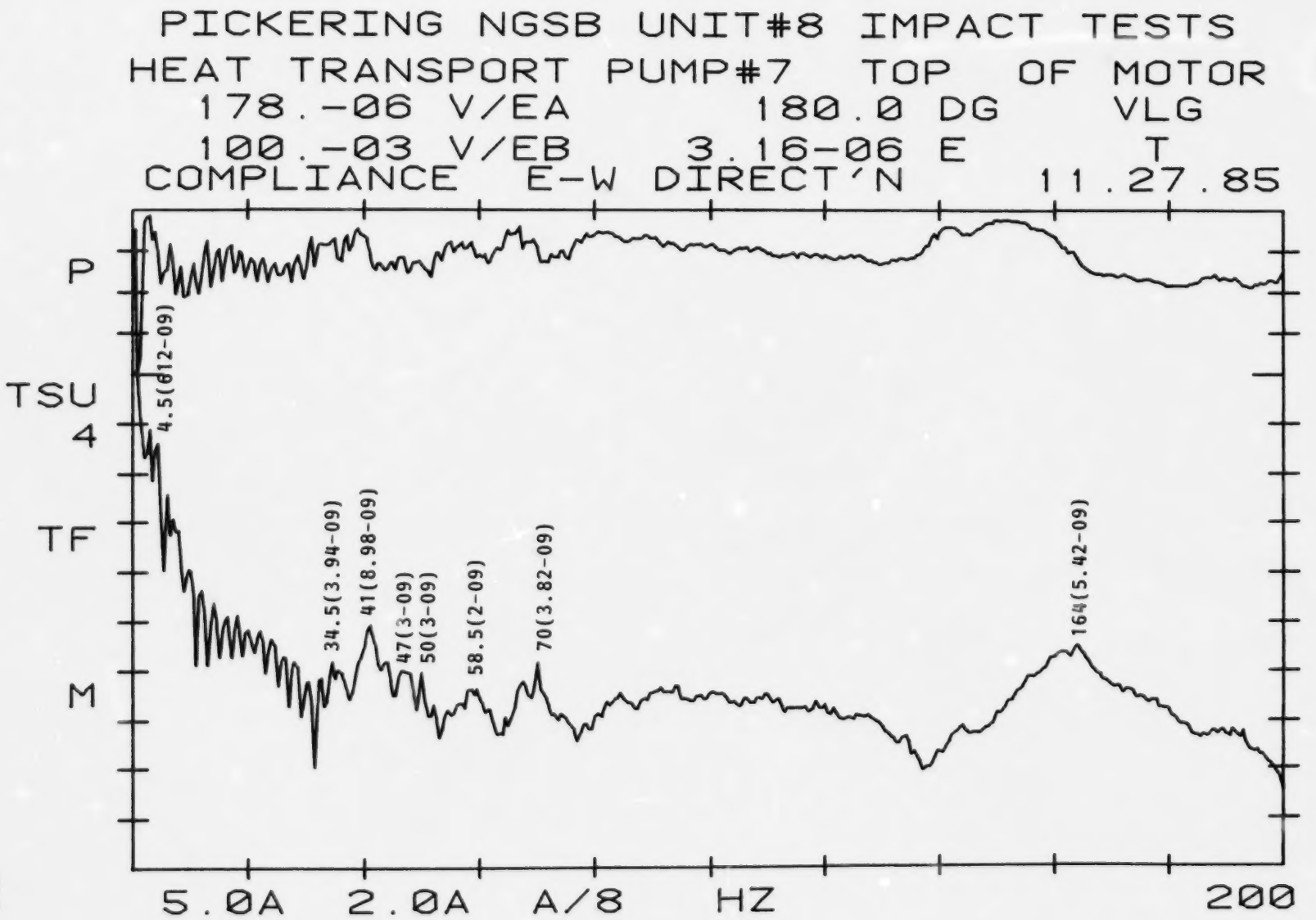

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#7 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU
4
TF
M
4.5(612-09)
34.5(3.94-09)
41(8.98-09)
47(3-09)
50(3-09)
58.5(2-09)
70(3.82-09)
164(5.42-09)
5.0A
2.0A
A/8
HZ
200

FIG. B18

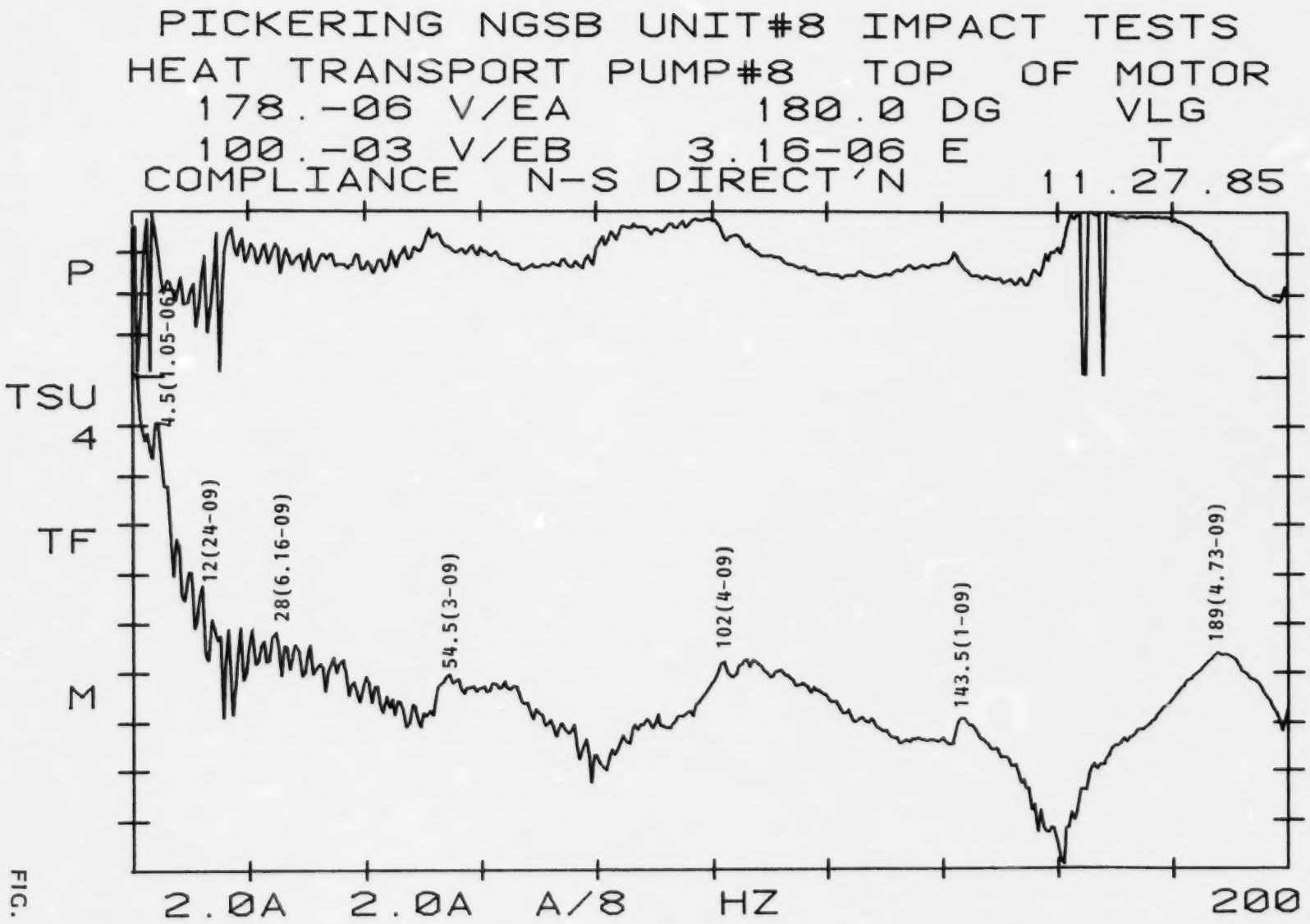


FIG. B19

86-311

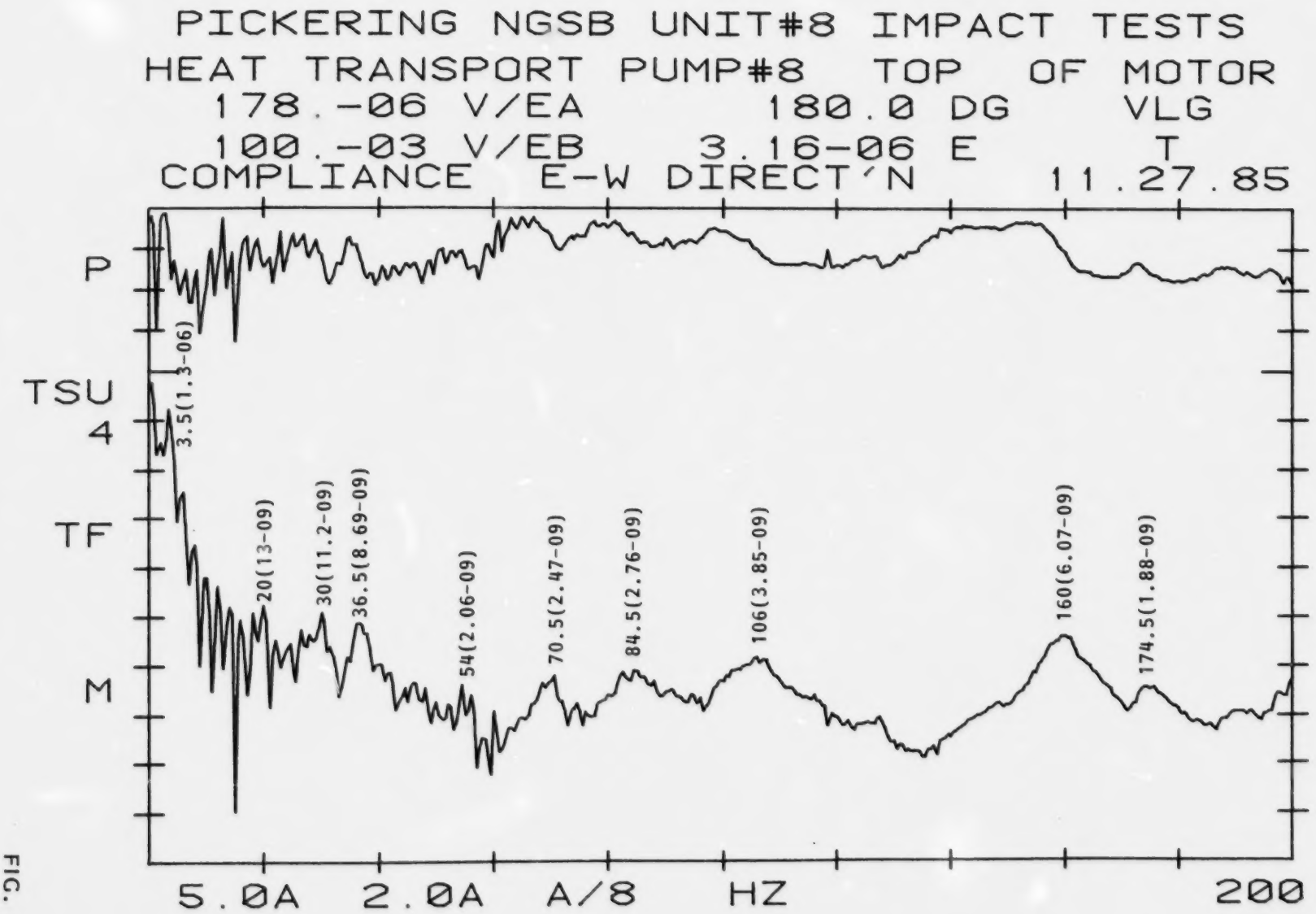


FIG. B20

86-311

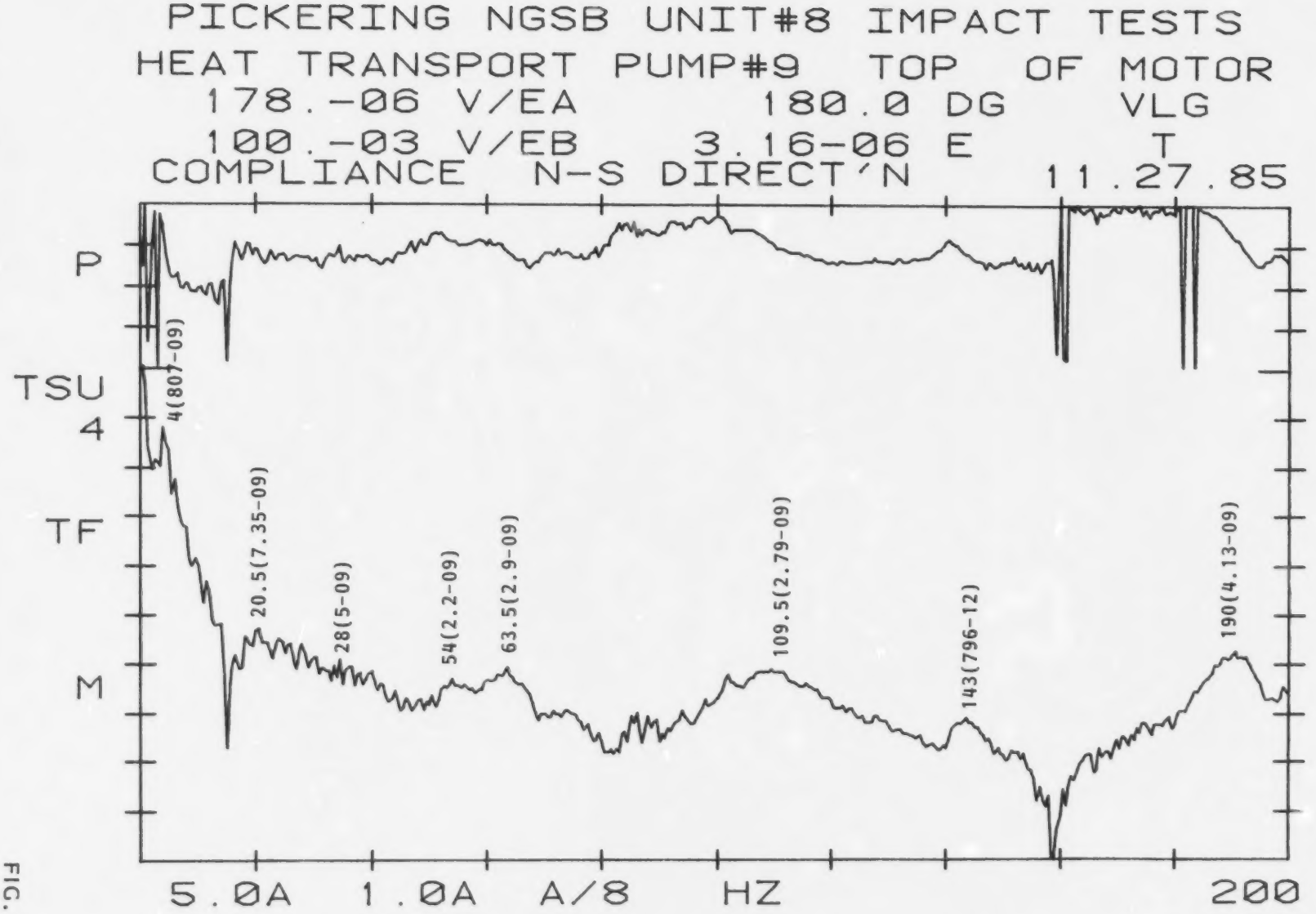


FIG. B21

86-311

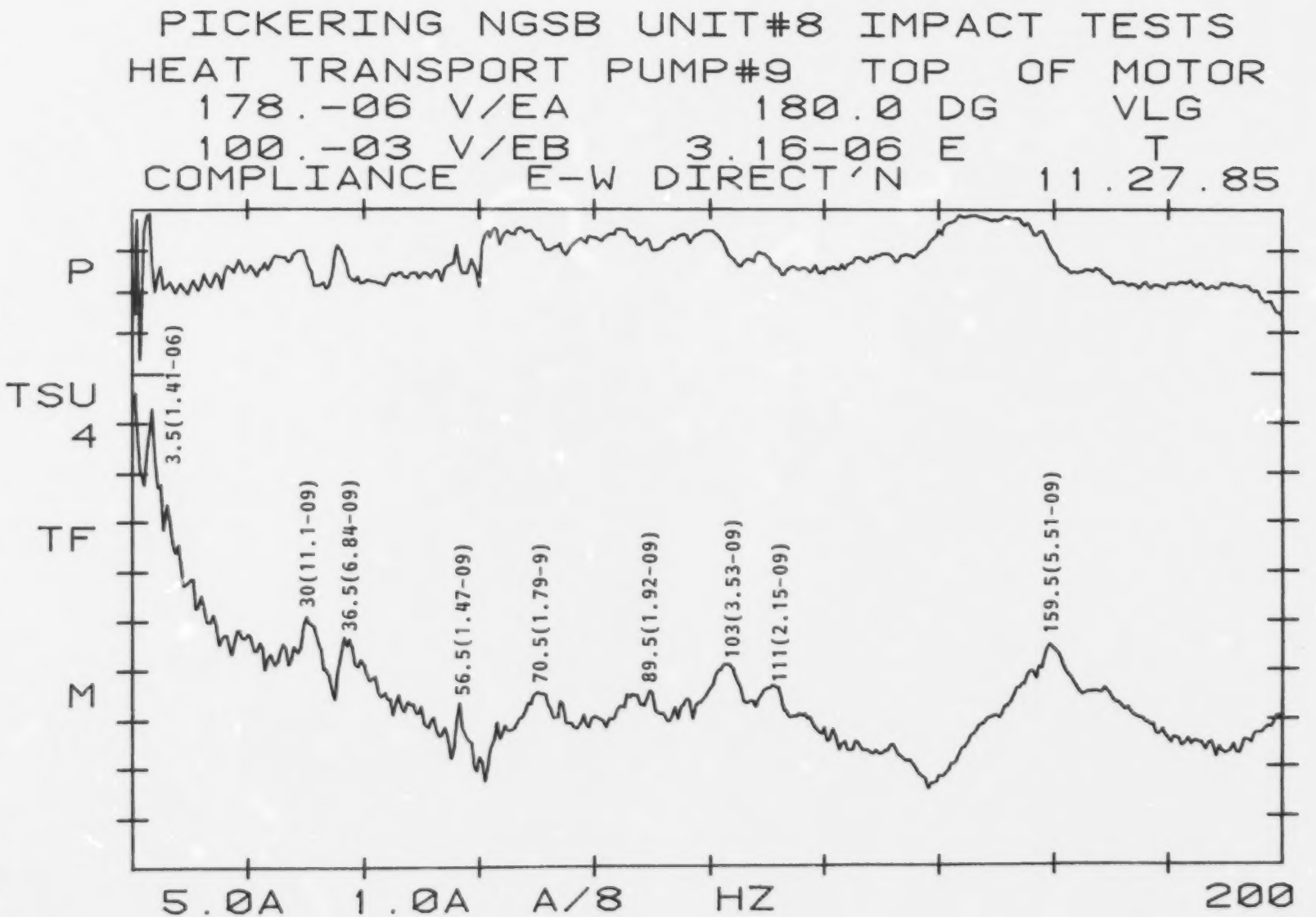


FIG. B22
86-311

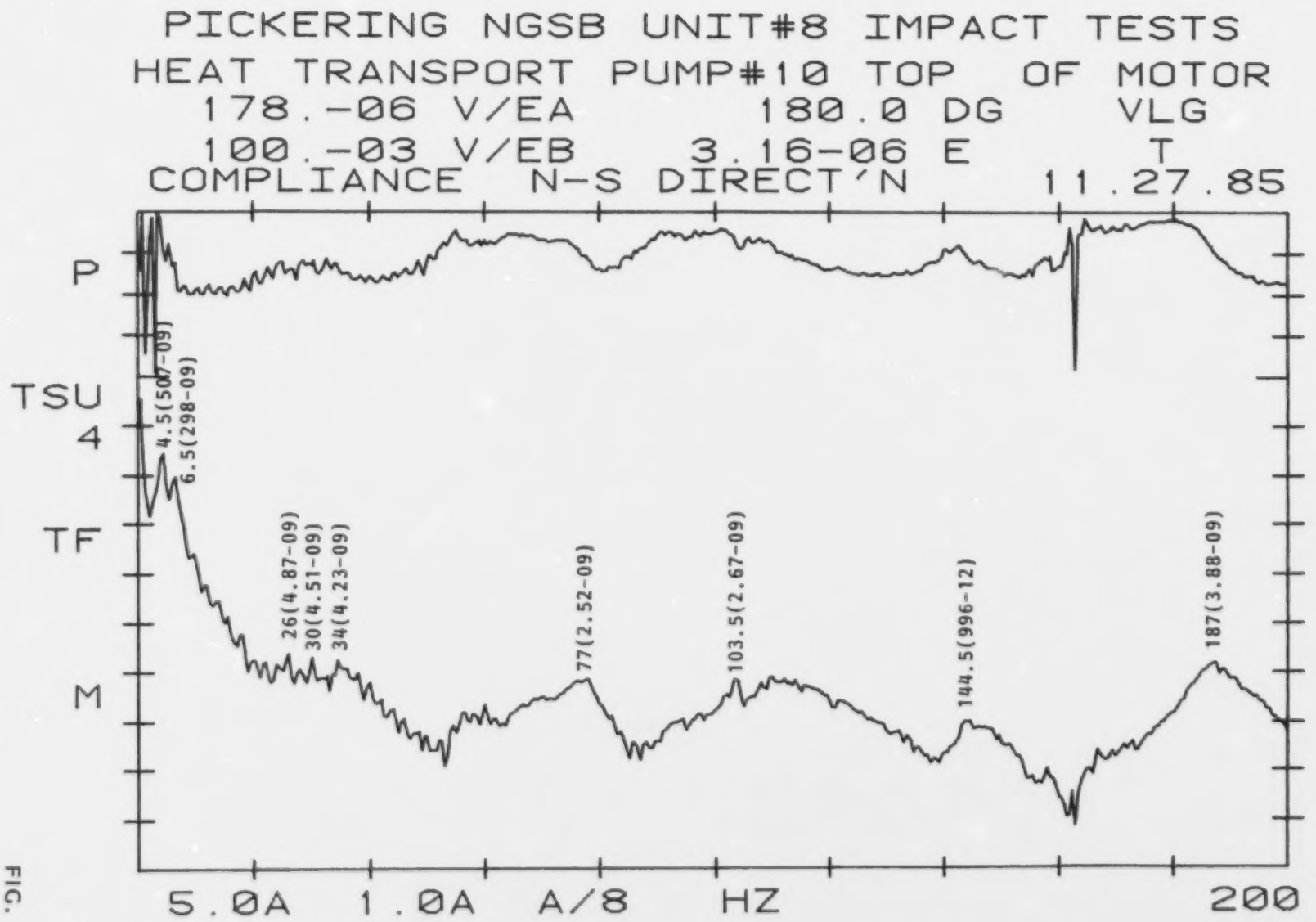


FIG. B23

86-311

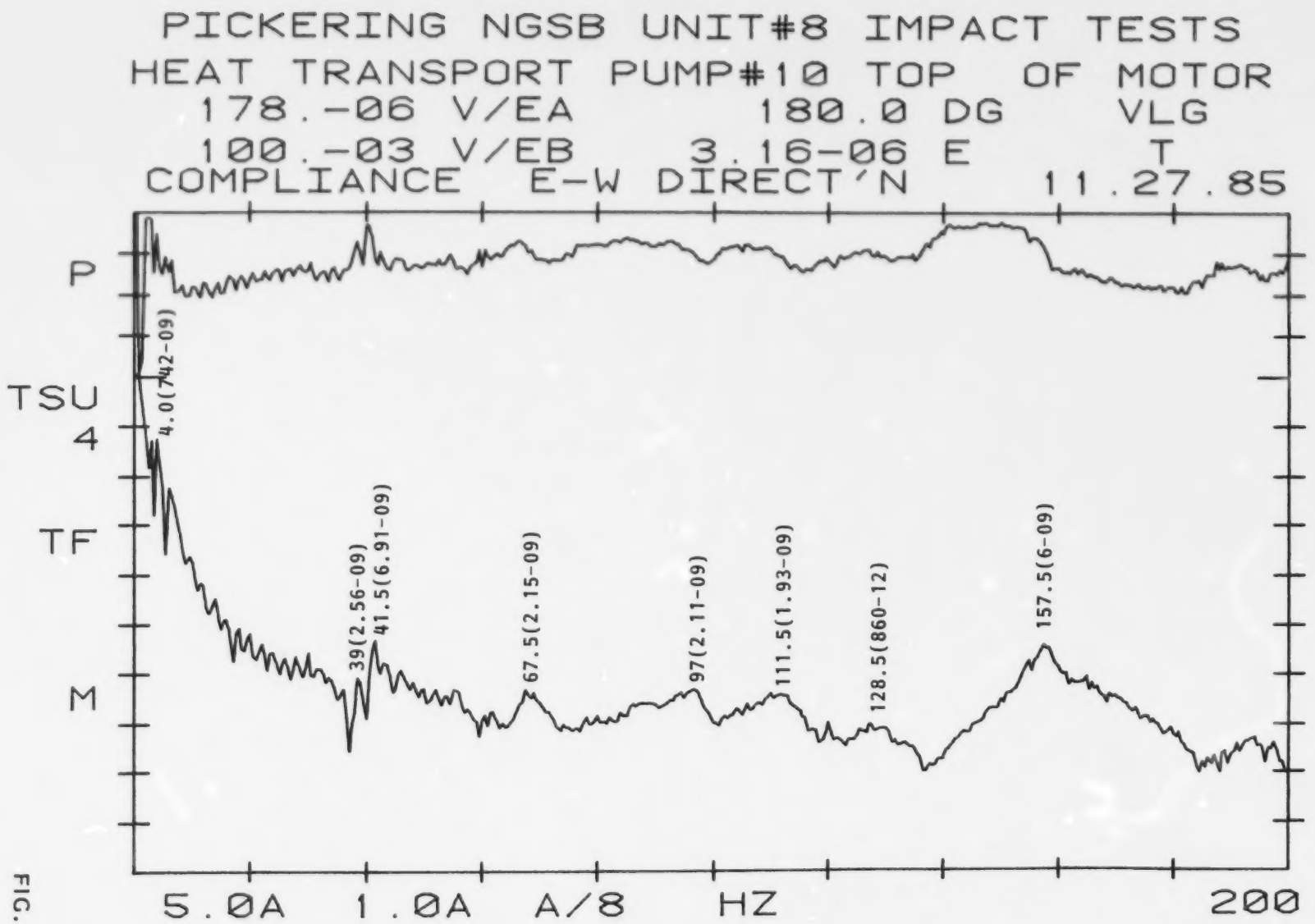
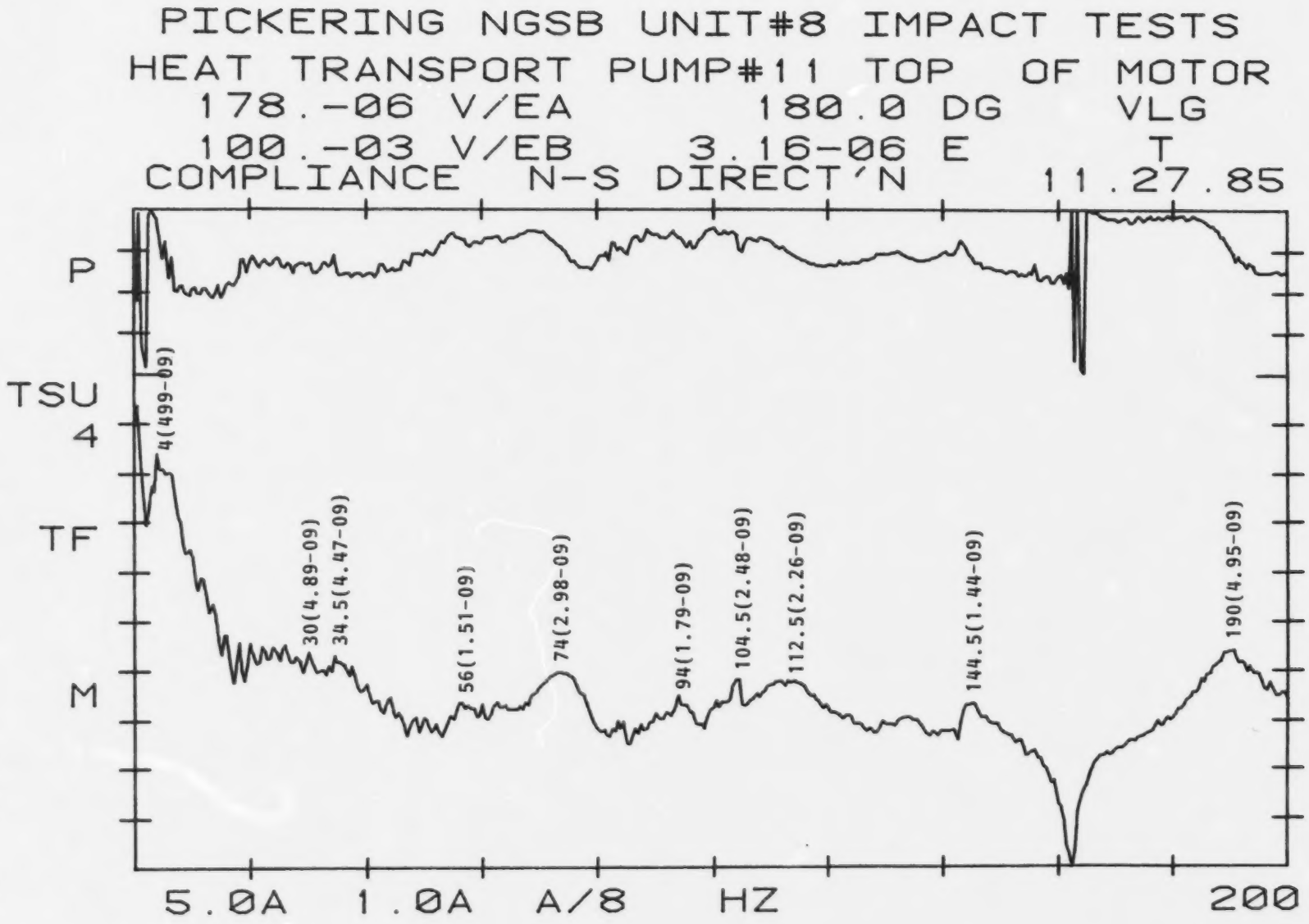

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#10 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU
4
TF
M
4.0(7.42-09)
39(2.56-09)
41.5(6.91-09)
67.5(2.15-09)
97(2.11-09)
111.5(1.93-09)
128.5(860-12)
157.5(6-09)
5.0A
1.0A
A/8
HZ
200

FIG. B24



86-311 FIG. B25

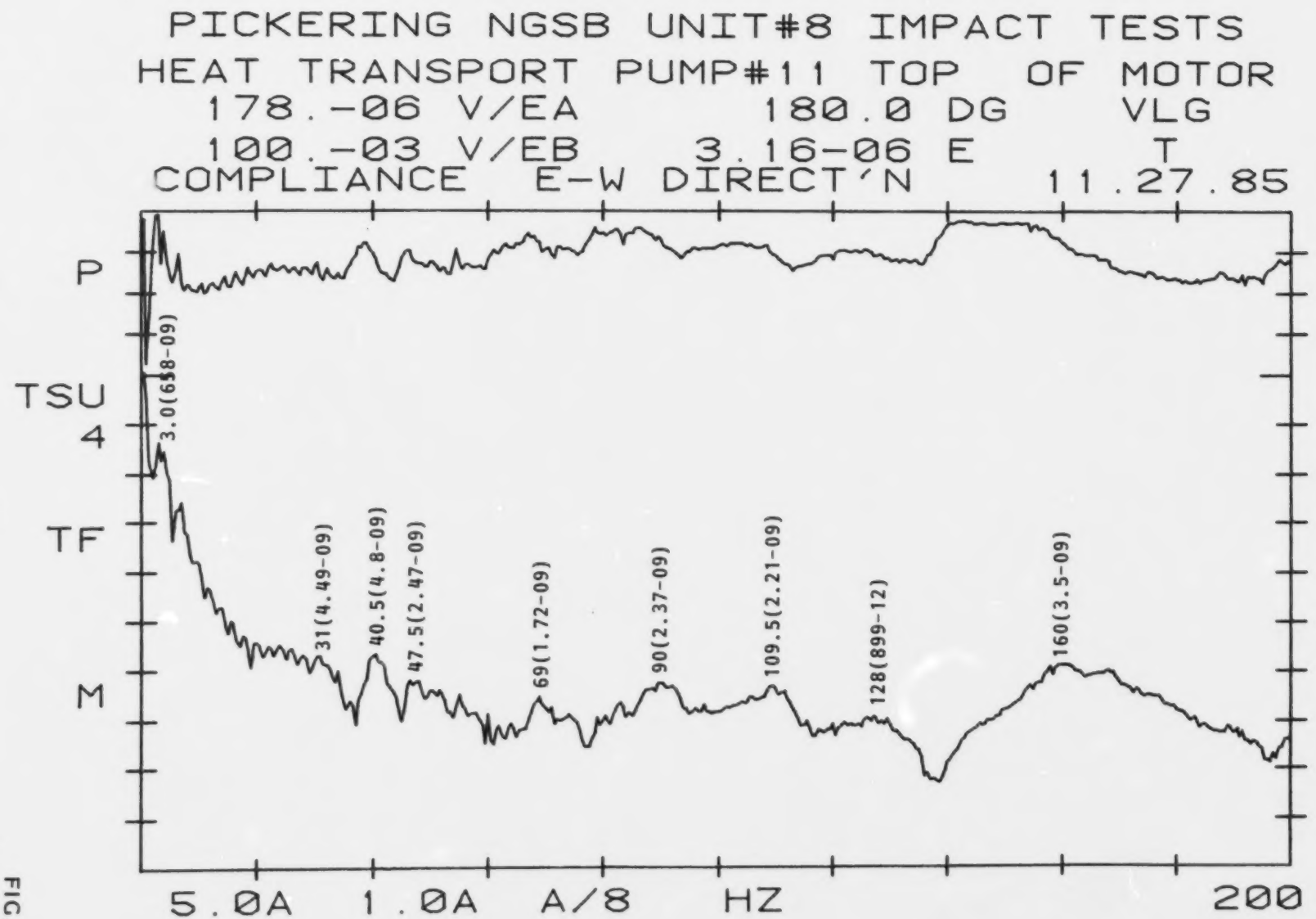


FIG. B26
86-311

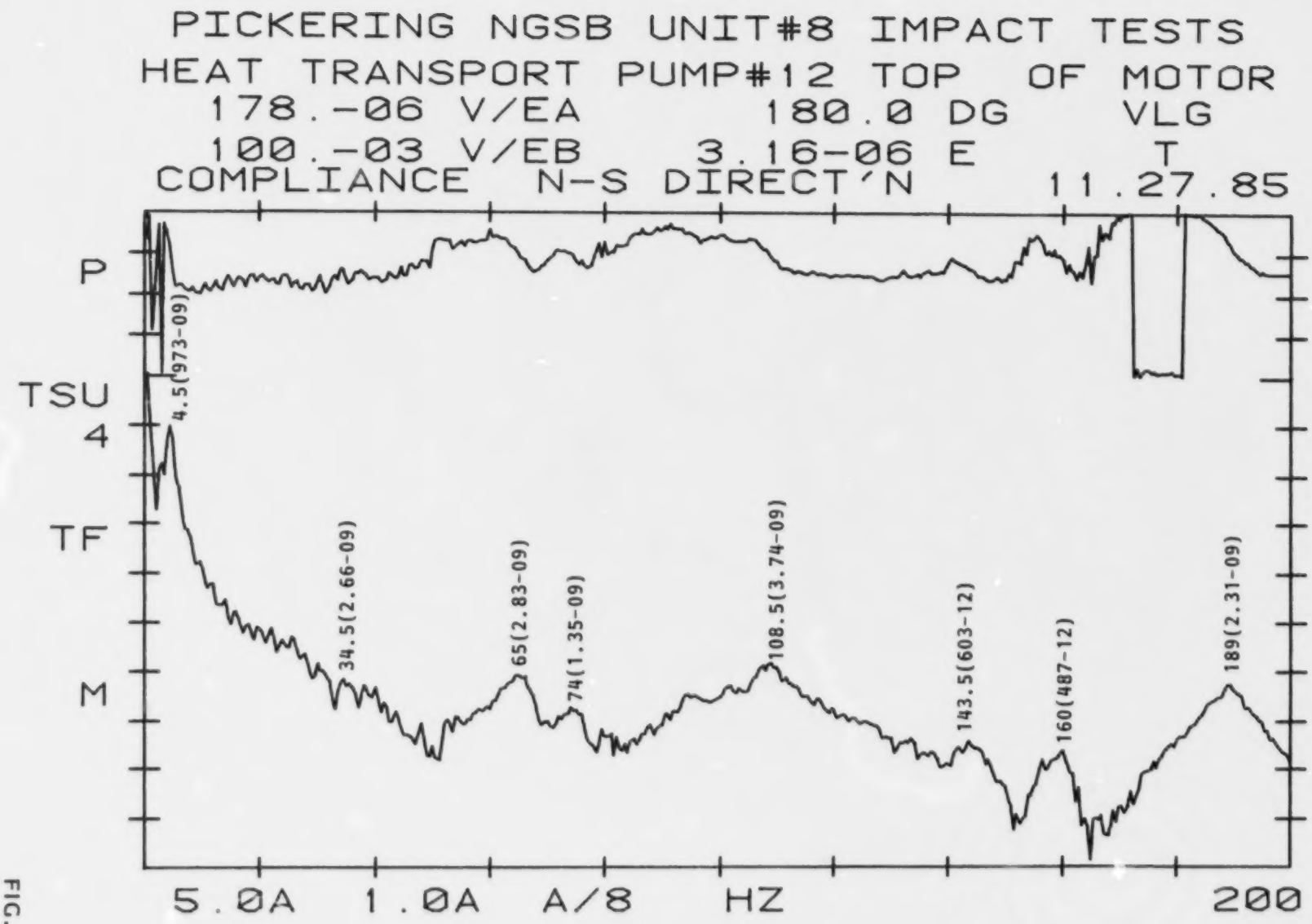


FIG. B27
98-311

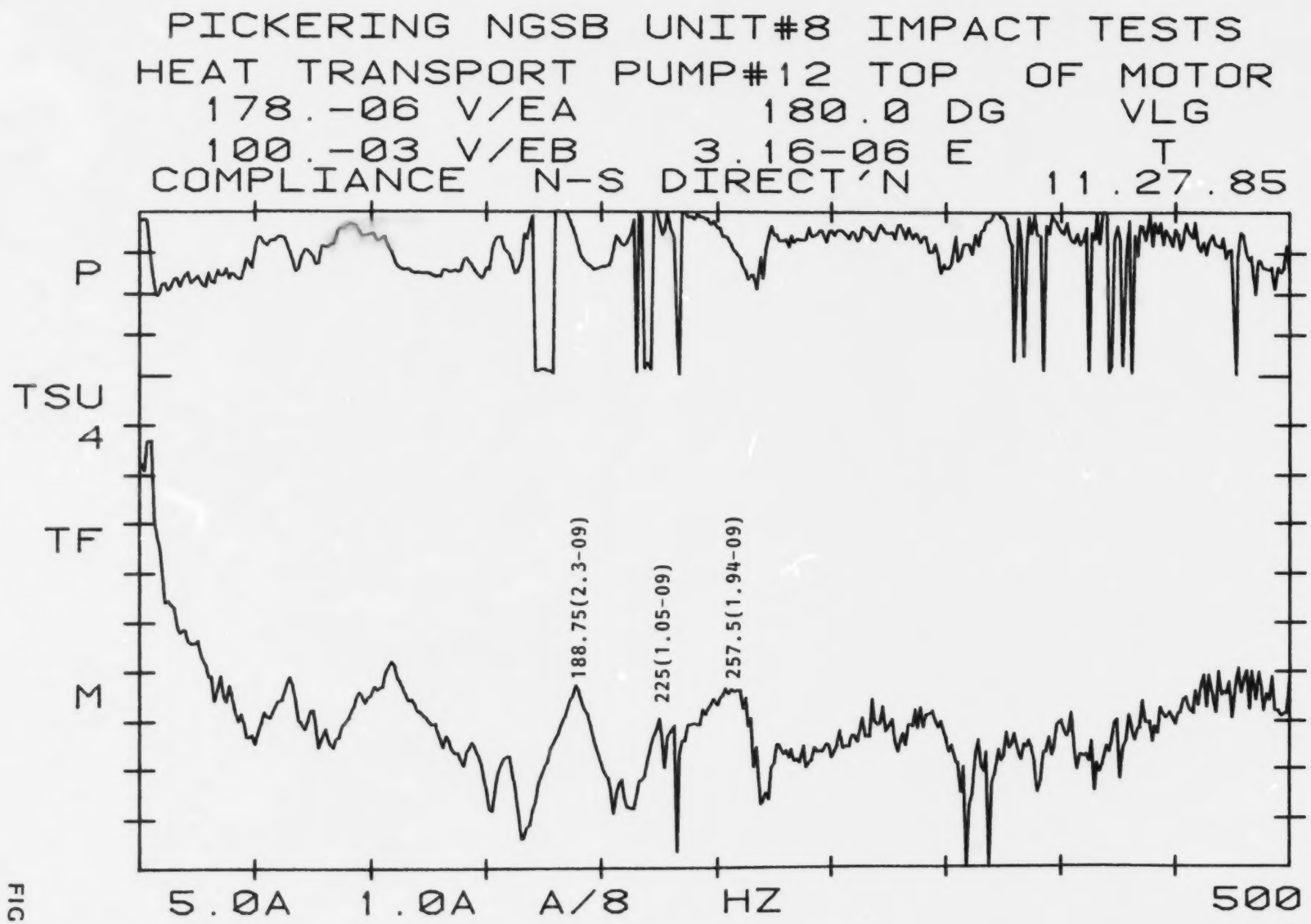


FIG. B28

86-311

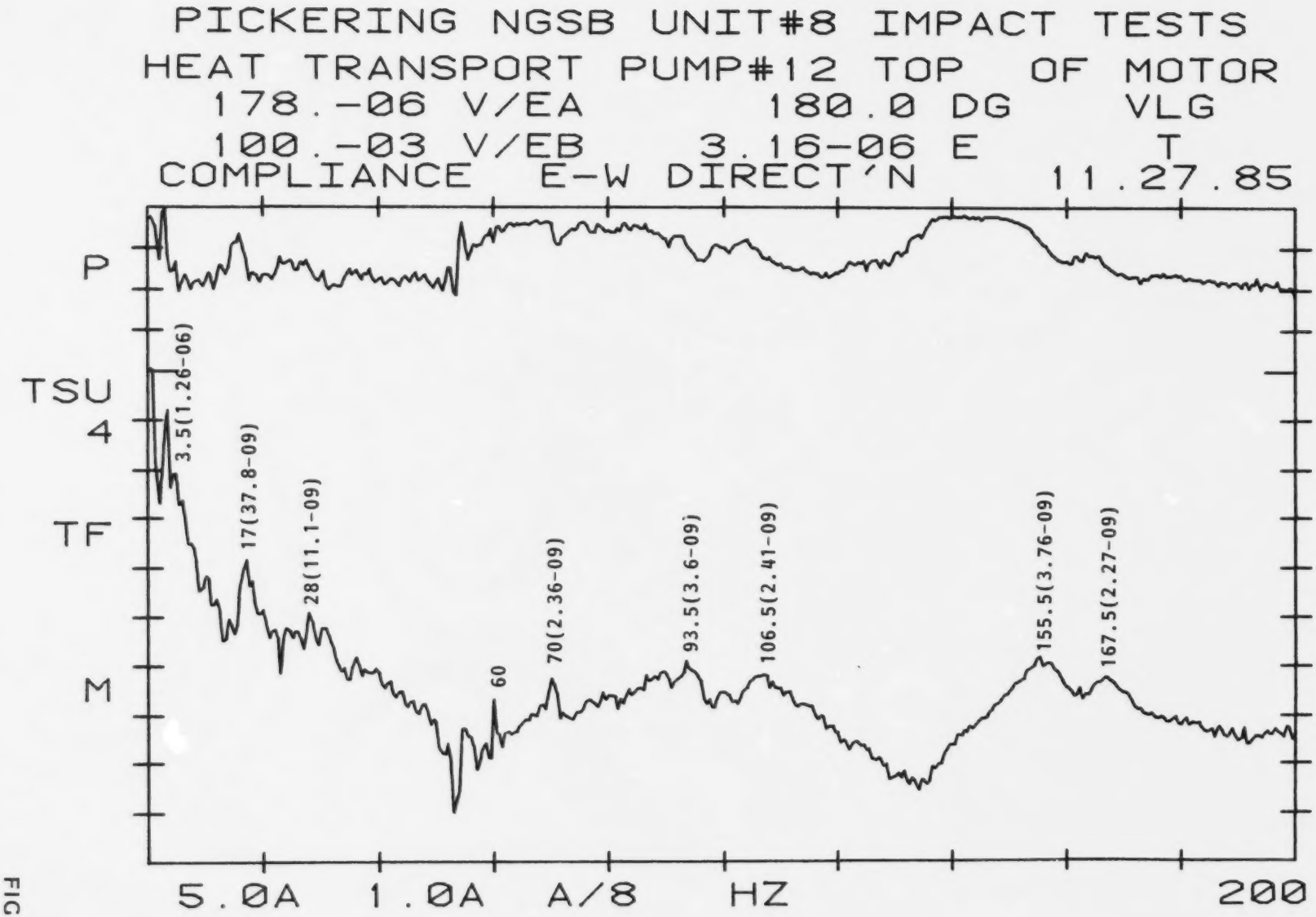


FIG. B29

86-311

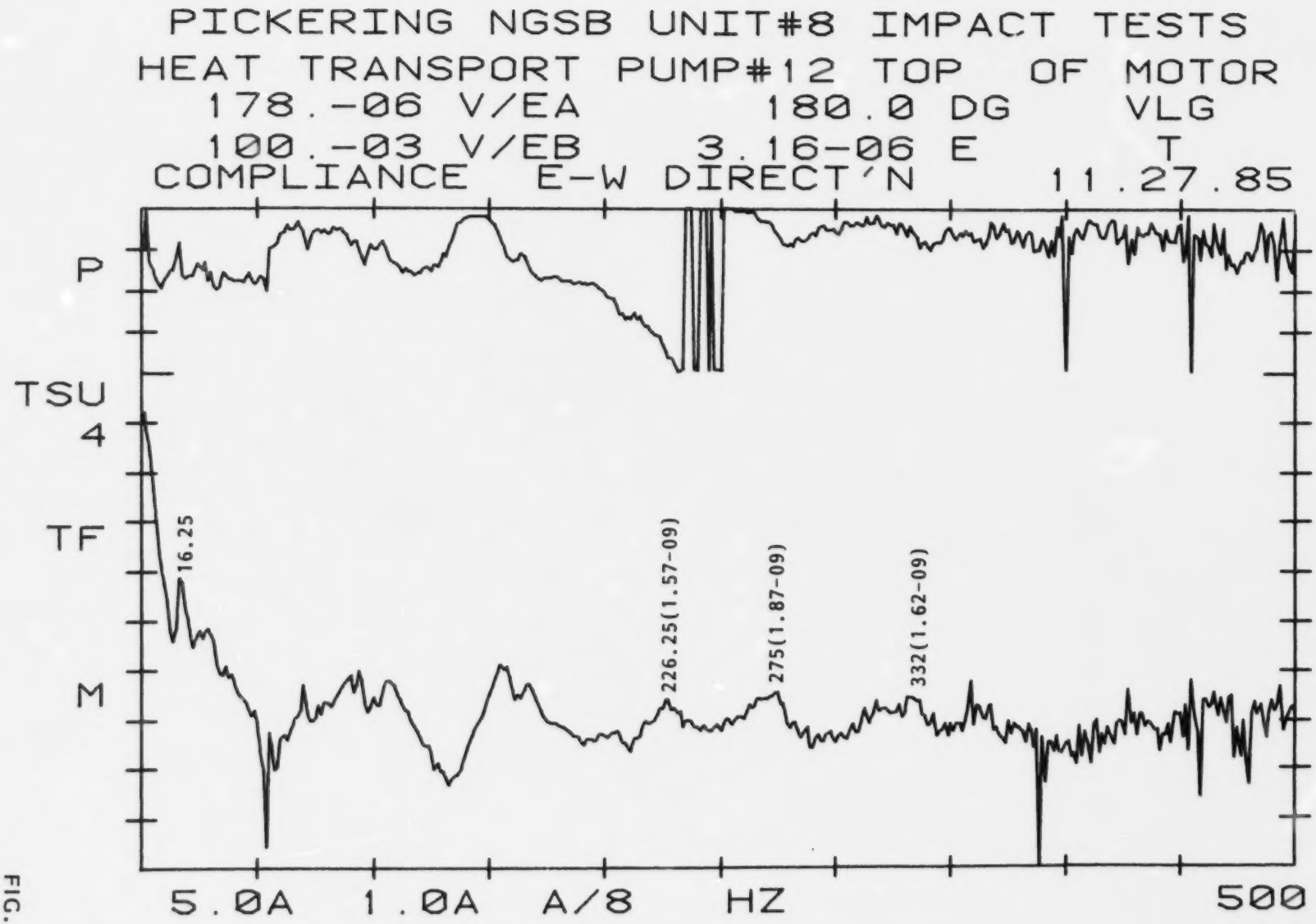


FIG. B30
86-311

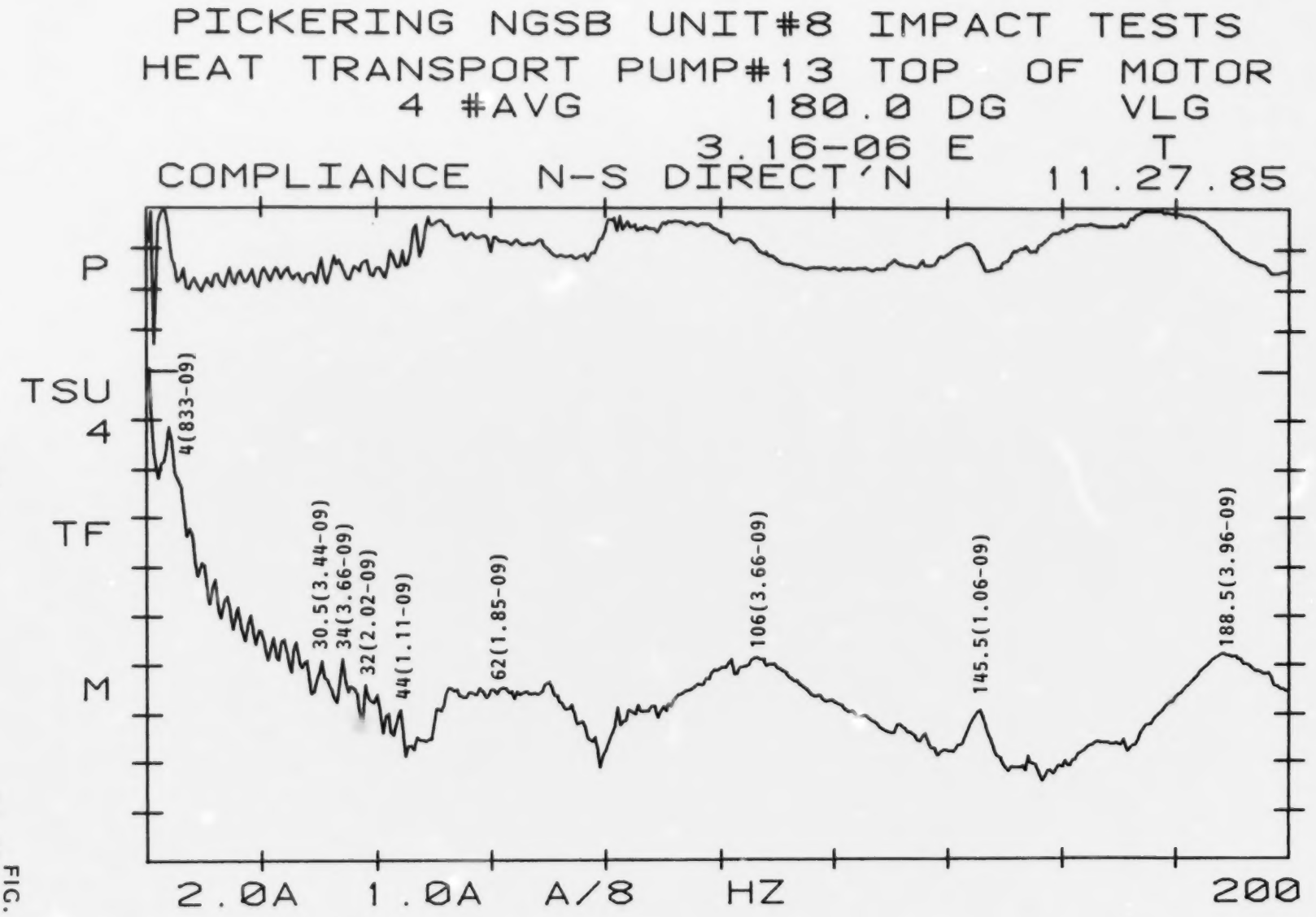
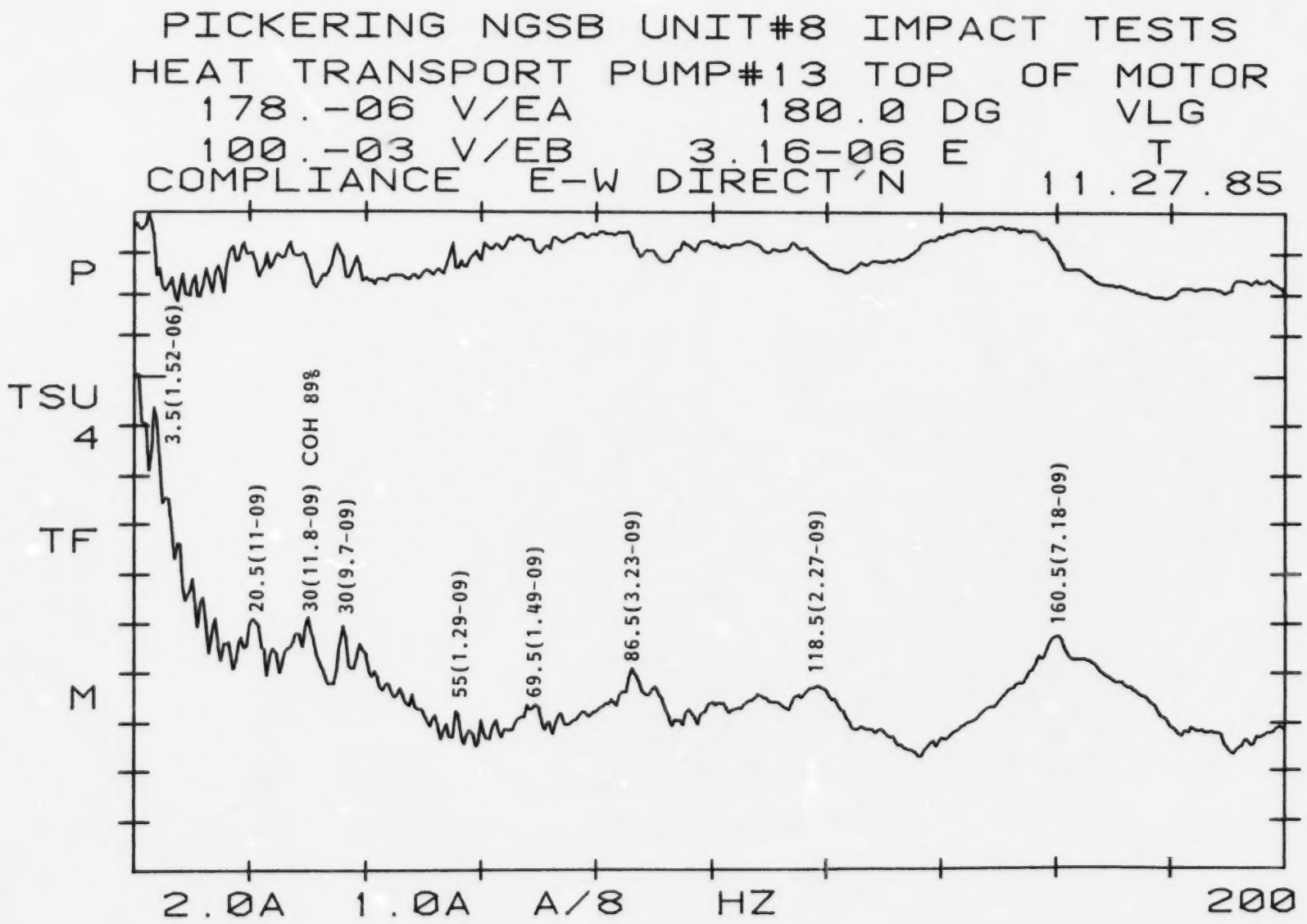
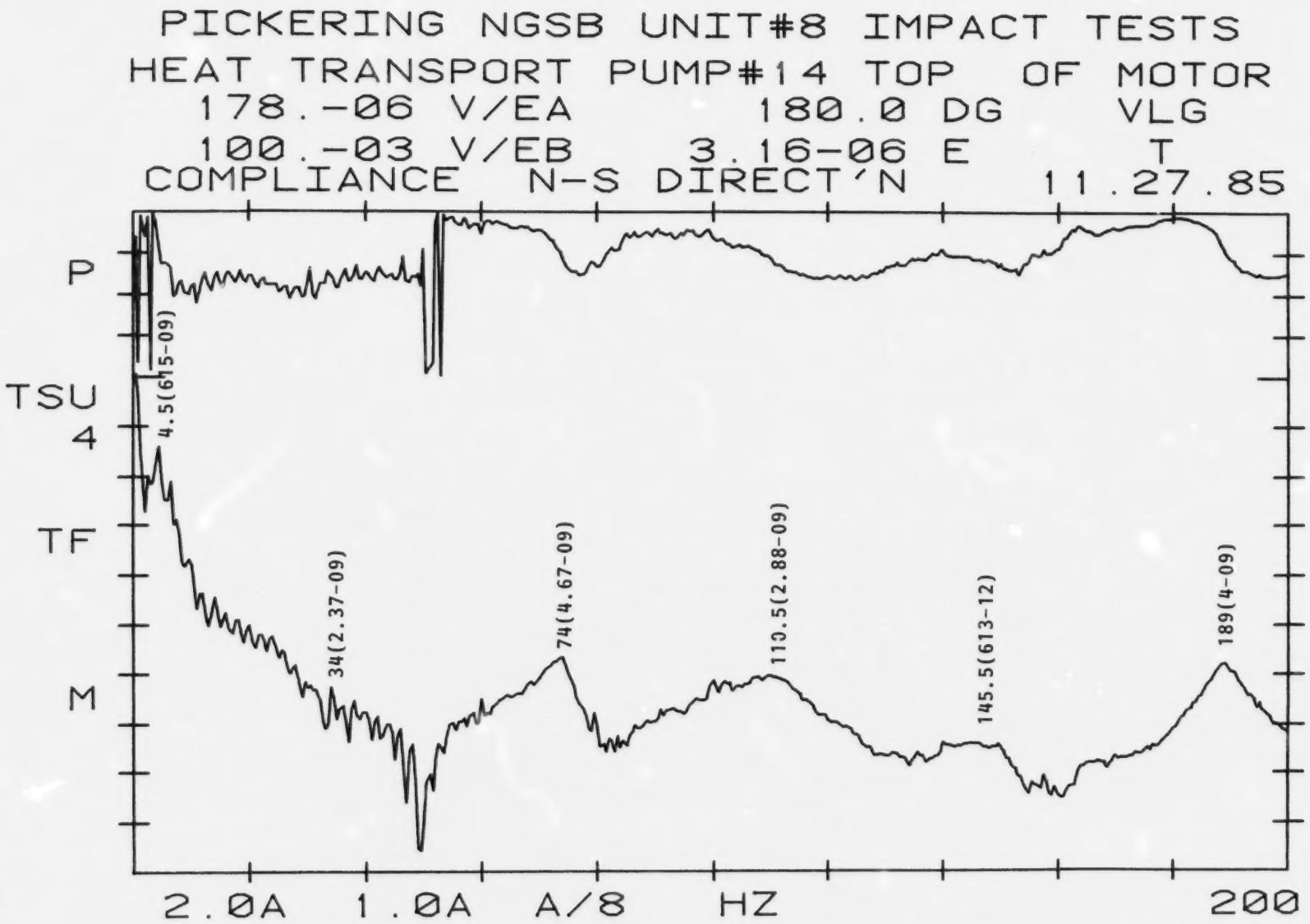


FIG. B31
86-311



86-311 FIG. B32



86-311 FIG. B33

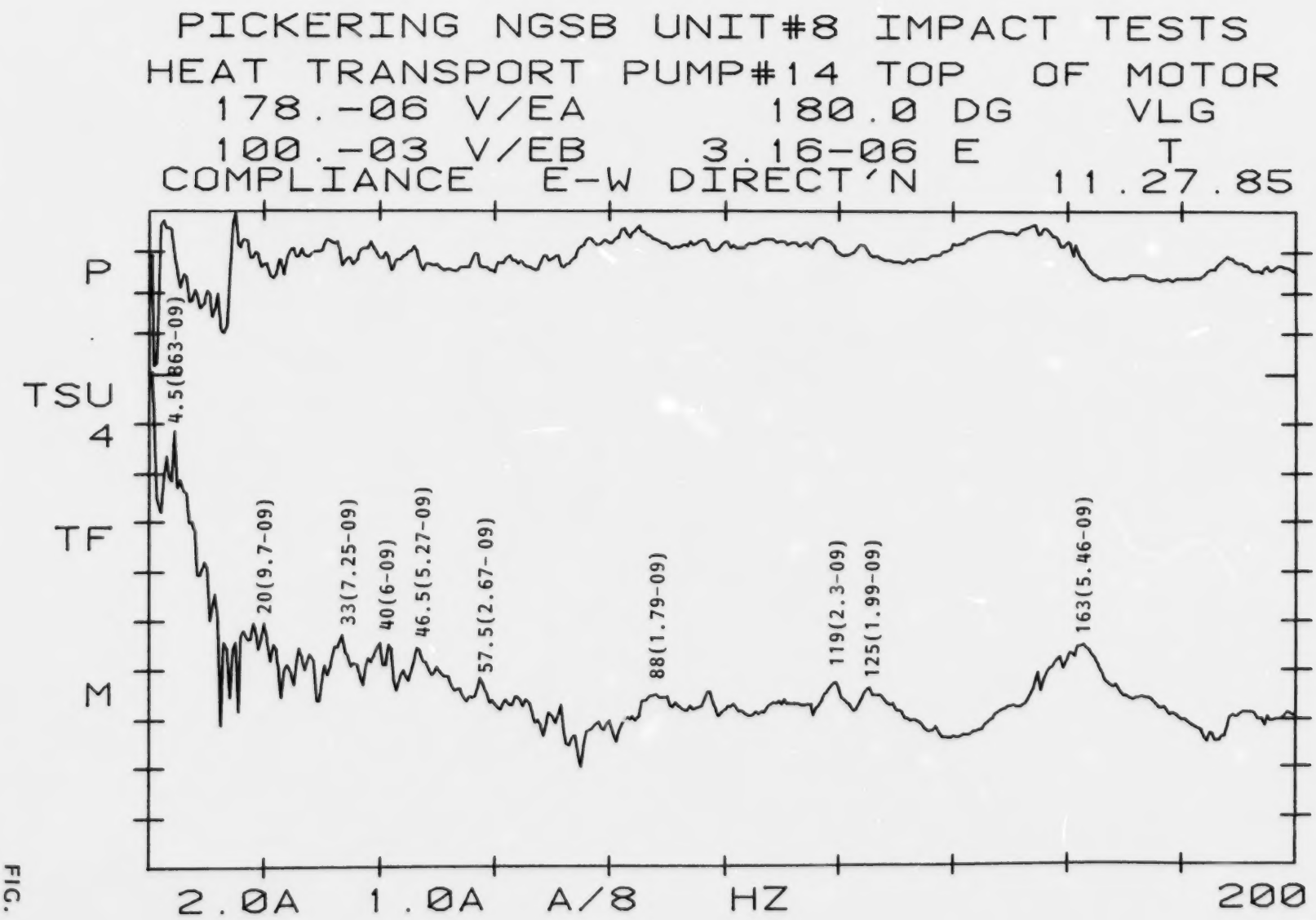


FIG. B34
86-311

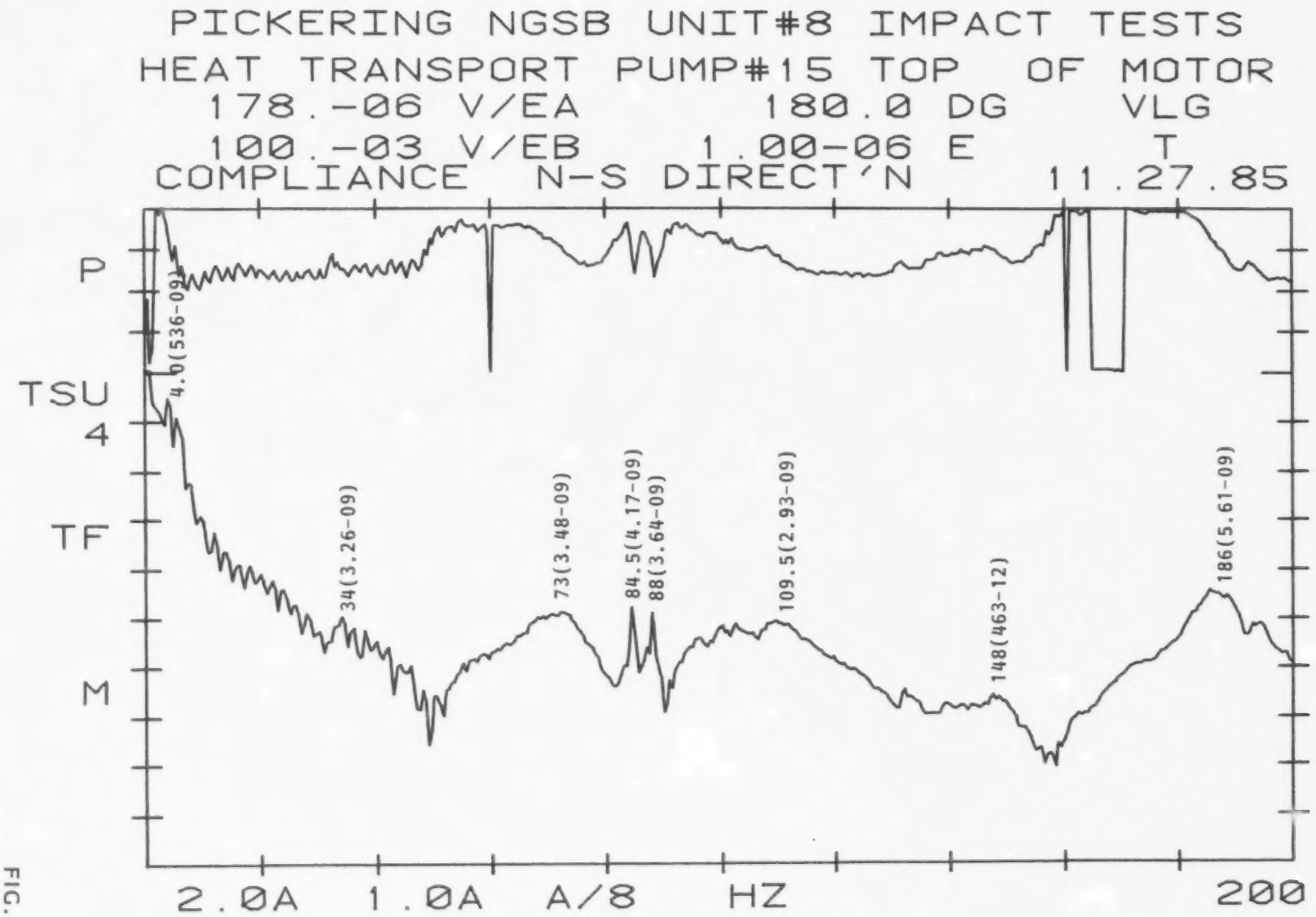


FIG. B35
86-311

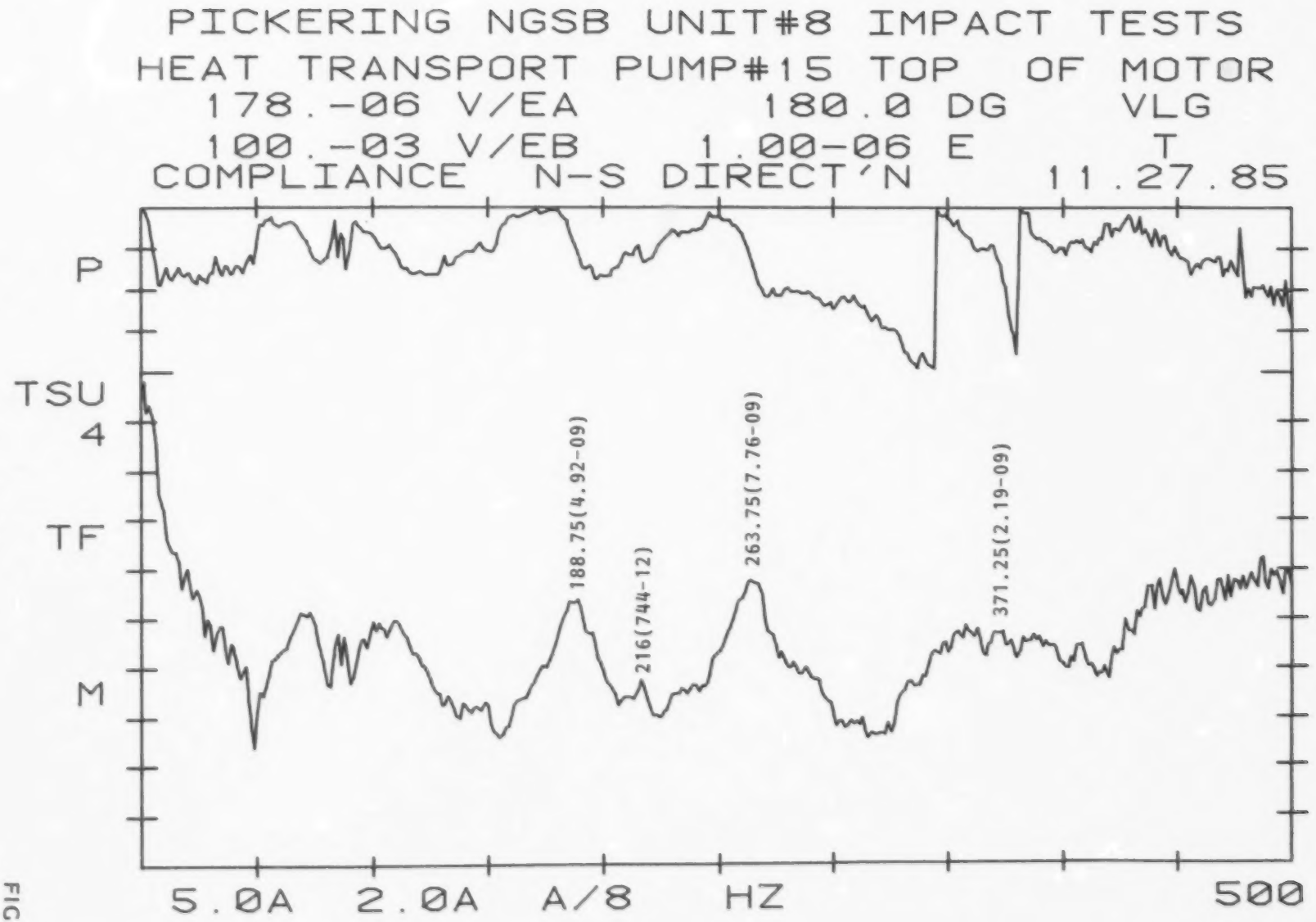


FIG. B36
86-311

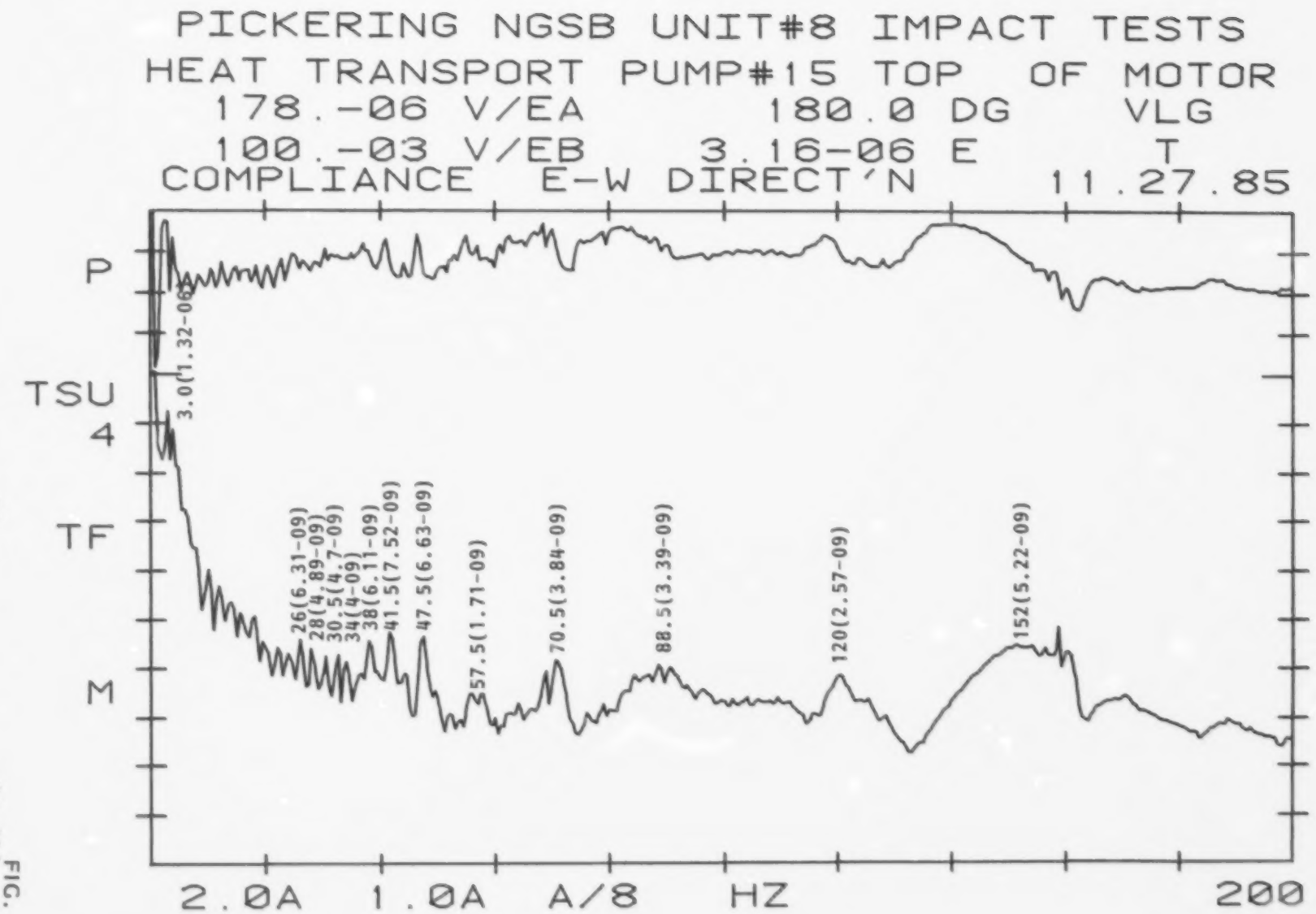

PICKERING NGSB UNIT#8 IMPACT TESTS
HEAT TRANSPORT PUMP#15 TOP OF MOTOR
178.-06 V/EA 180.0 DG VLG
100.-03 V/EB 3.16-06 E T
COMPLIANCE E-W DIRECT'N 11.27.85
P
TSU
4
TF
M
3.0(1.32-06)
26(6.31-09)
28(4.89-09)
30.5(4.7-09)
34(4-09)
38(6.11-09)
41.5(7.52-09)
47.5(6.63-09)
57.5(1.71-09)
70.5(3.84-09)
88.5(3.39-09)
120(2.57-09)
152(5.22-09)
2.0A
1.0A
A/8
HZ
200

FIG. B37

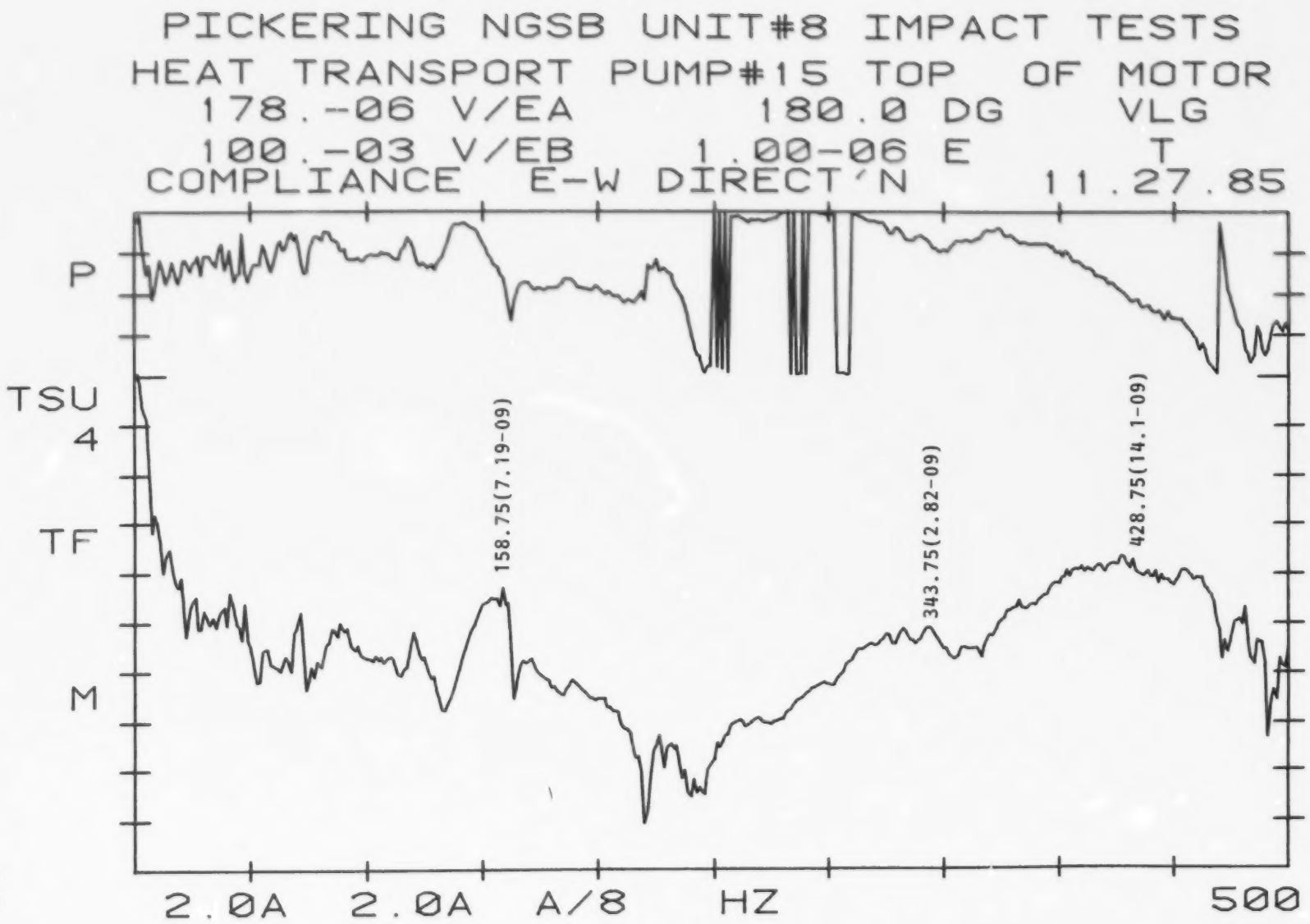


FIG. B38
86-311

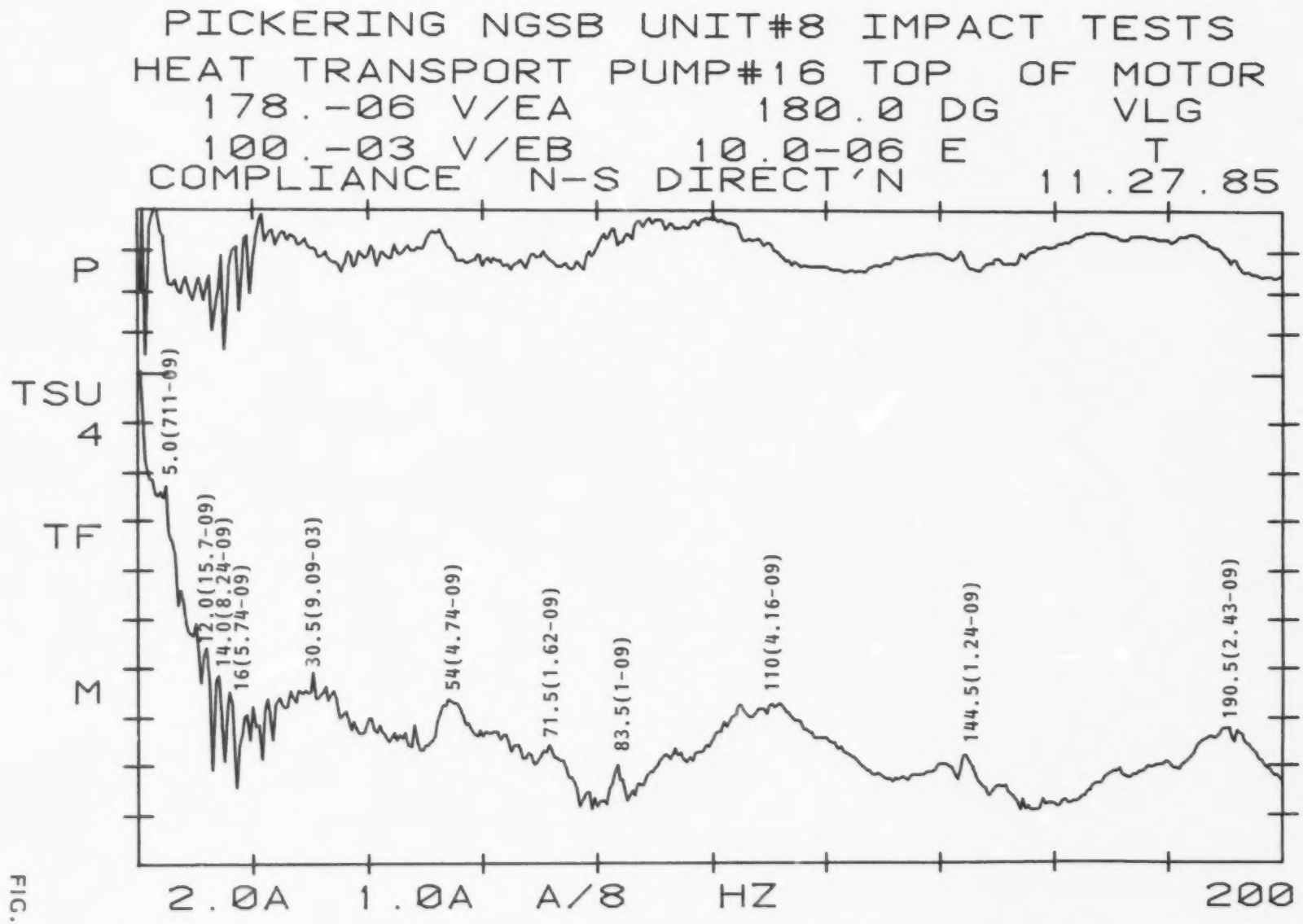


FIG. B39

86-311

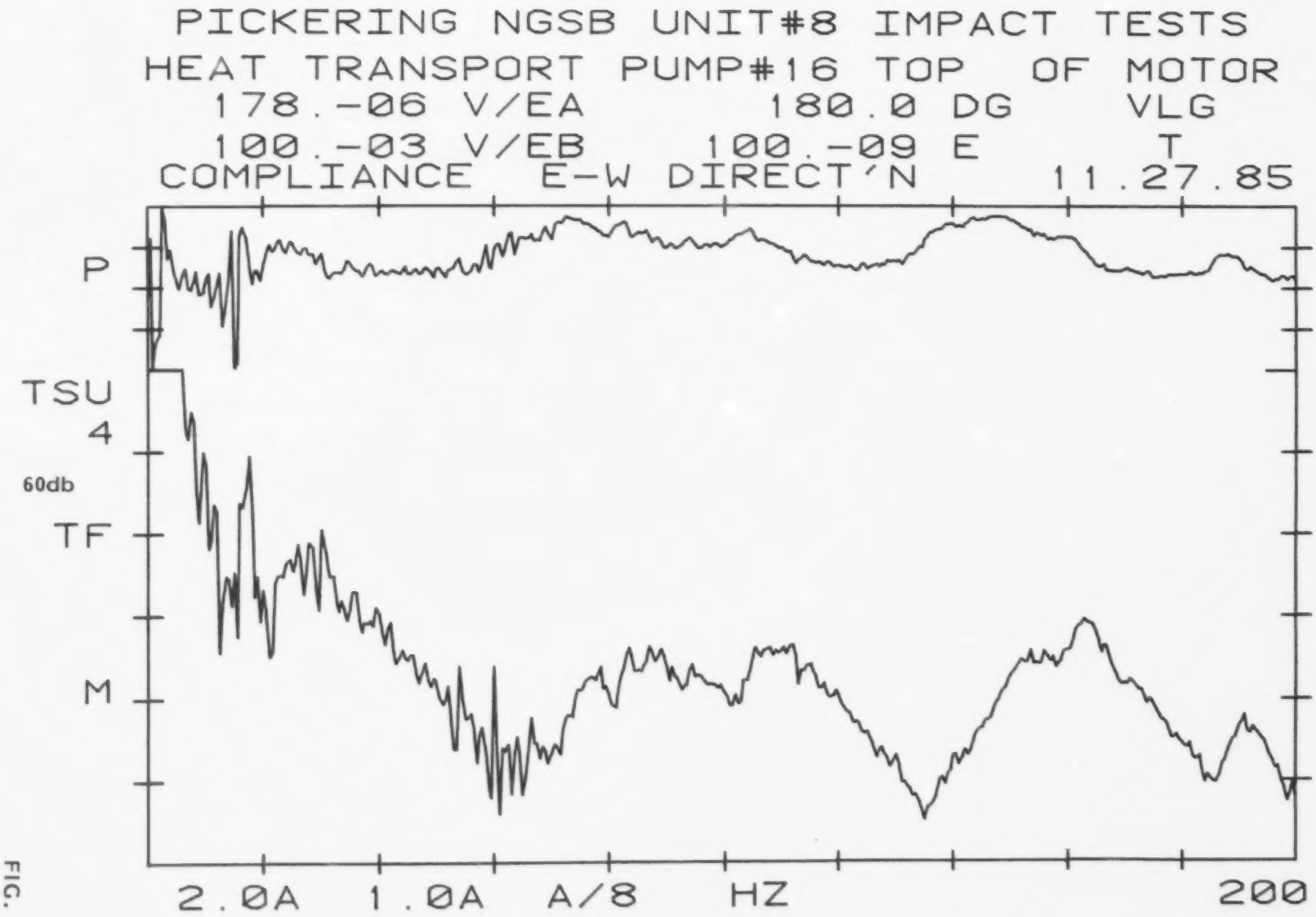


FIG. B40 86-311

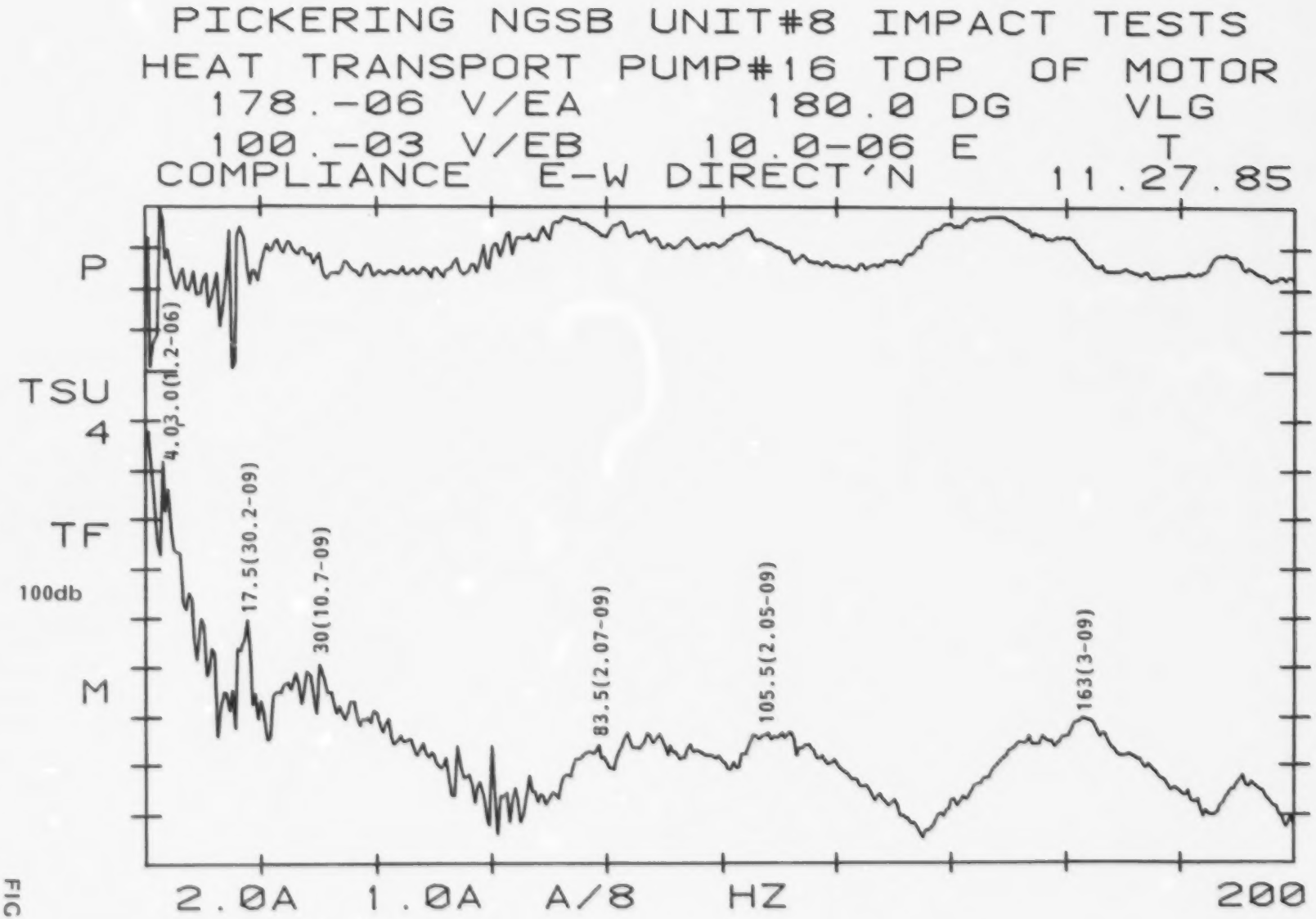


FIG. B41

86-311

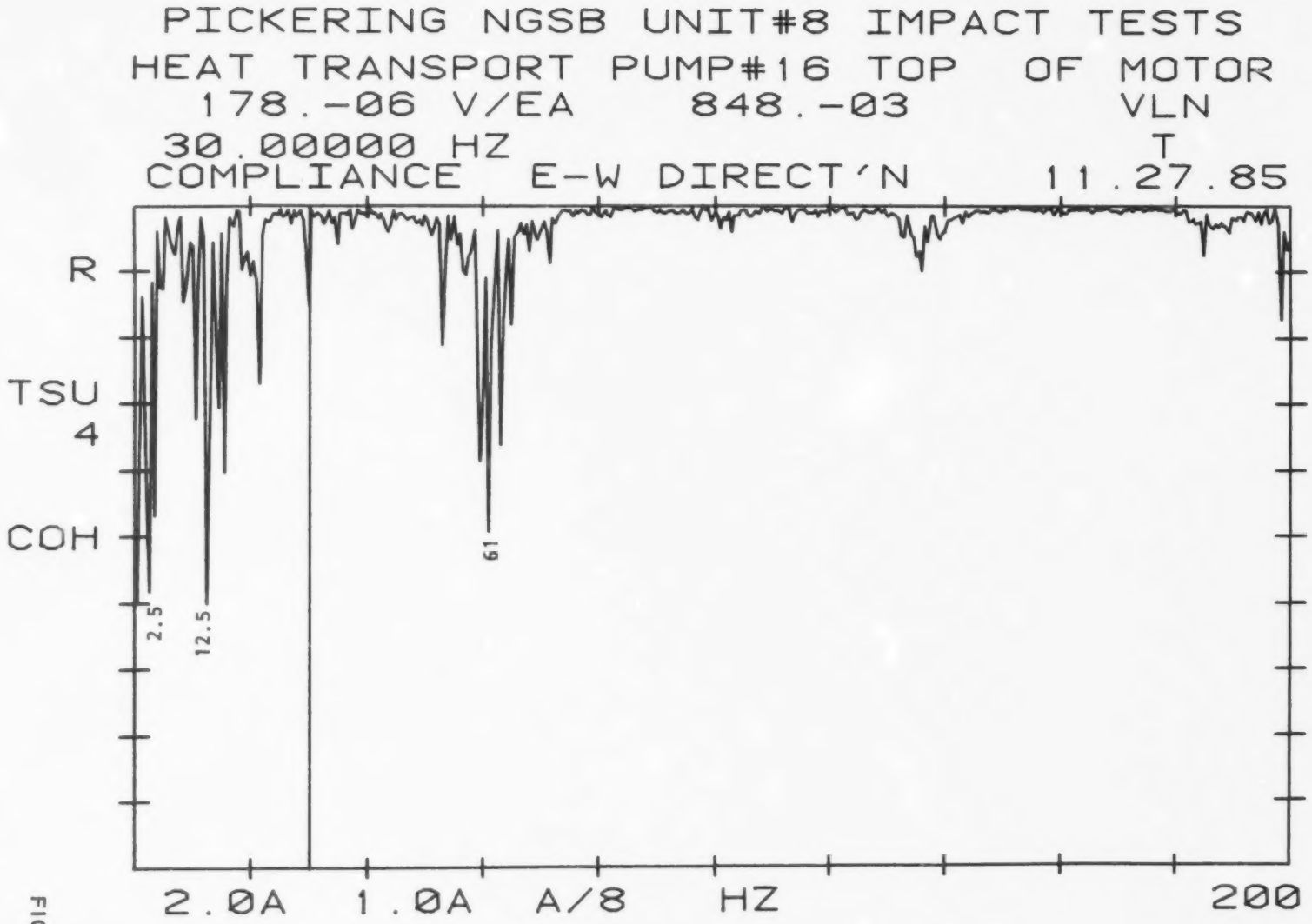


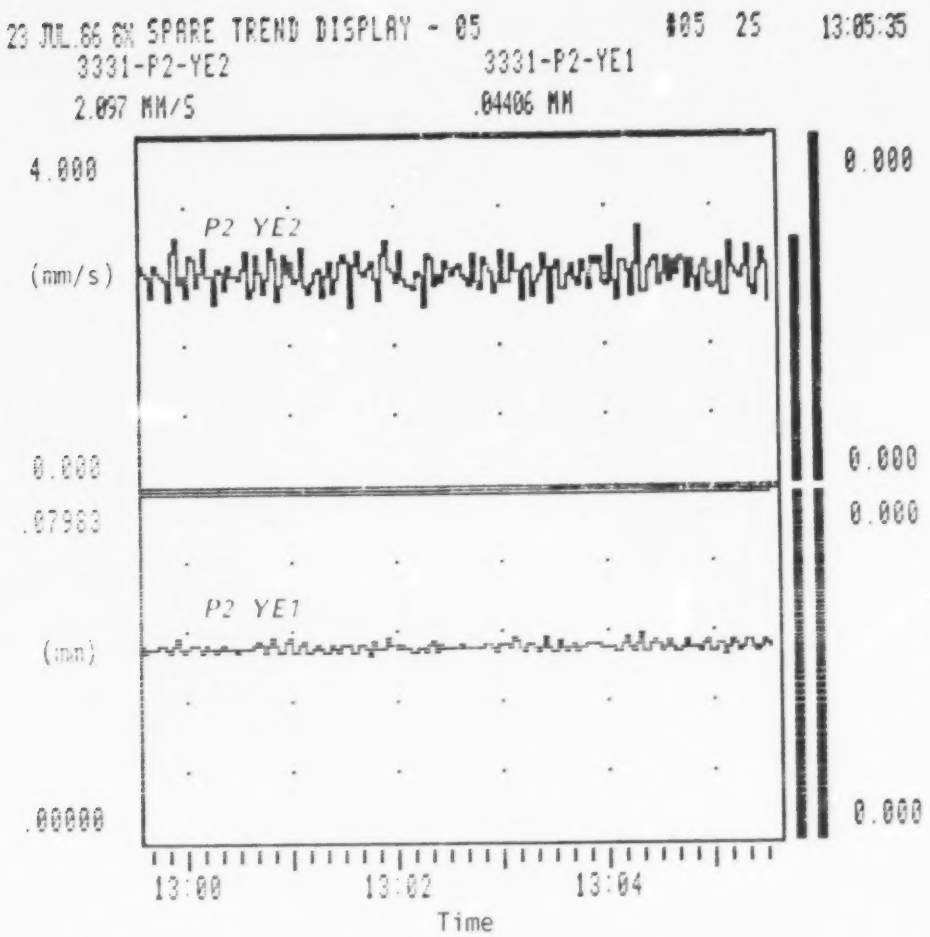
FIG. B42

86-311

APPENDIX C

PHT PRESSURIZING PUMPSETS - VIBRATION VELOCITY AND SHAFT DISPLACEMENT (RUNOUT) AGAINST TIME AT FULL UNIT LOAD

Pumpset	Figure No
P1	No Data Available
P2	C1



YE1 = Shaft Displacement (Runout)
YE2 = Vibration Velocity

FIGURE C1

PHT PRESSURIZING PUMPSET VIBRATION VELOCITY AND SHAFT DISPLACEMENT (RUNOUT) AGAINST TIME AT FULL UNIT LOAD

APPENDIX D

PHT PRESSURIZING PUMPSETS - VIBRATION VELOCITY AND SHAFT DISPLACEMENT (RUNOUT) SPECTRA AT FULL UNIT LOAD

Pumpset	Figure	Frequency Range Hz
P1		No Data Available
P2		1-200 velocity)no data available
		1-500 Velocity)
	D1	1-200 displacement
	D2	1-500 displacement

PICKERING NGS"B" UNIT#8
PRESSURIZING PUMP#2 YE-1
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	80	.03782
2	119.5	.0131
3	179.5	4.551E-03
4	31.5	1.034E-03
5	8.5	1E-03
6	29.5	9.712E-04
7	5	9.515000000E-04
8	2.5	9.490000000E-04
9	53	8.844E-04
10	36.5	8.47E-04
11	33	8.188E-04
12	40	7.499E-04
13	19.5	7.448E-04
14	75	7.428E-04
15	23	7.378E-04
16	27	7.239E-04
17	50.5	7.2E-04
18	38.5	7.152E-04
19	43	7.123E-04
20	41.5	7.104E-04

4.72+00 V/EA 316.-03 E VLG

C

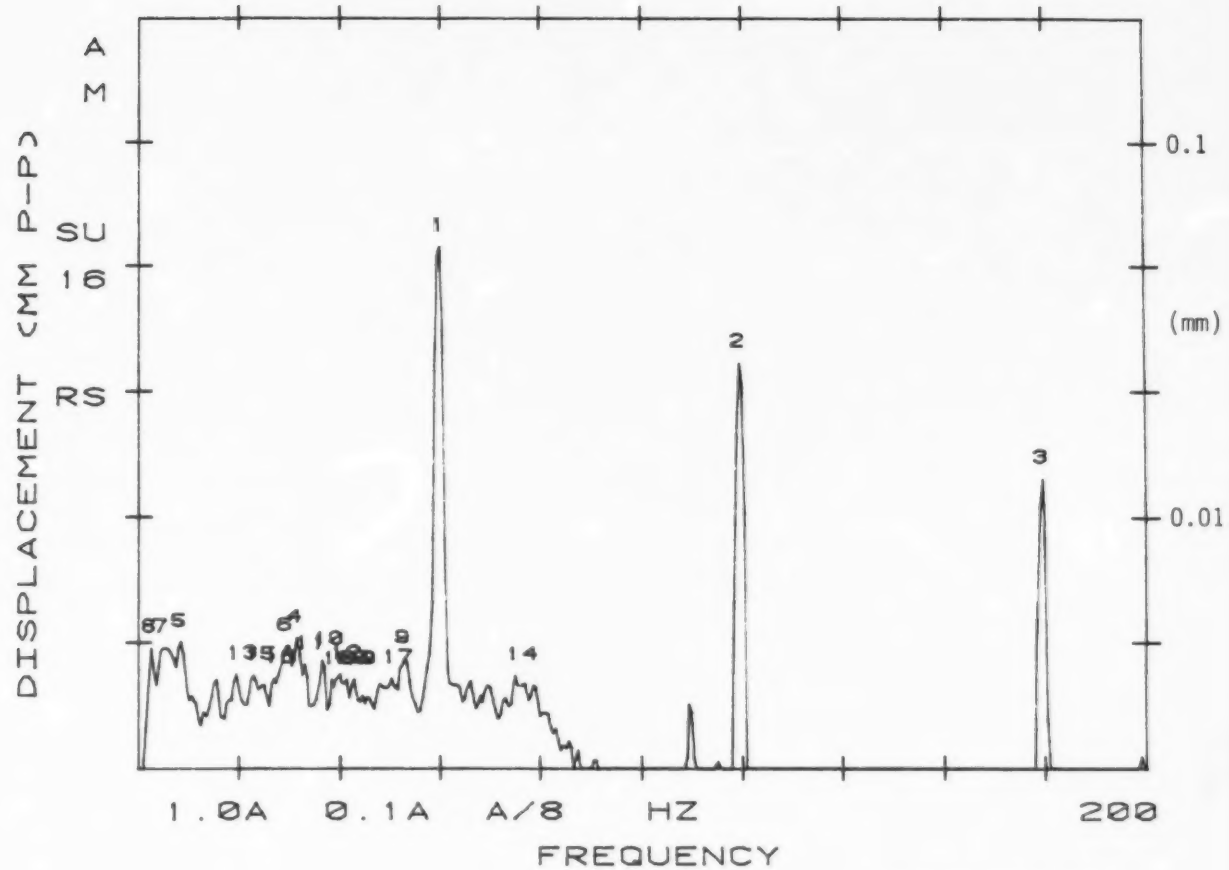


FIGURE D1

172734 RD

PICKERING NGS"B" UNIT#8
PRESSURIZING PUMP#2 YE-1
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	60	.04008
2	120	.01284
3	238.75	4.408E-03
4	358.75	4.376E-03
5	180	4.311E-03
6	418.75	3.425E-03
7	478.75	2.577E-03
8	298.75	2.422E-03
9	5	1.609E-03
10	31.25	1.598E-03
11	55	1.514E-03
12	40	1.478E-03
13	78.75	1.415E-03
14	12.5	1.203E-03
15	47.5	1.082E-03
16	73.75	9.85599999E-04
17	17.5	9.712E-04
18	51.25	9.698E-04
19	23.75	9.078E-04
20	70	9.039E-04

4.72+00 V/EA 316.-03 E VLG

C

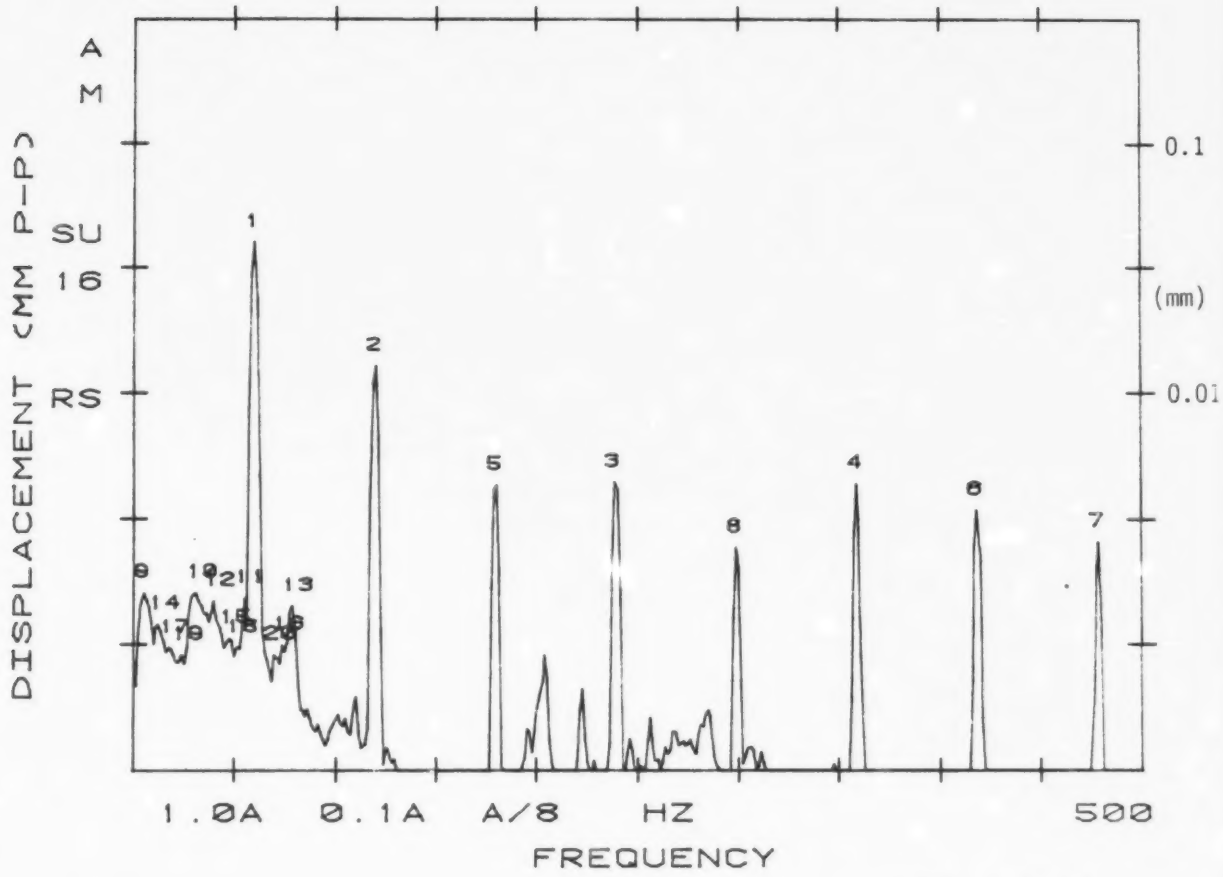


FIGURE D2

172735 RD

APPENDIX E

PHT CIRCULATING PUMPSET - VIBRATION VELOCITY AND SHAFT DISPLACEMENT AGAINST TIME AT FULL UNIT LOAD

Pumpset	Measurement	Figure No.
P1	velocity	No Data Available
	displacement	E4
P2	velocity	E1
	displacement	E4
P3	velocity	No Data Available
	displacement	No Data Available
P4	velocity	E1
	displacement	E4
P5	velocity	No Data Available
	displacement	No Data Available
P6	velocity	E1
	displacement	E4
P7	velocity	E1
	displacement	E5
P8	velocity	E2
	displacement	E5
P9	velocity	E2
	displacement	E5
P10	velocity	E2
	displacement	E5
P11	velocity	E2
	displacement	E6
P12	velocity	No Data Available
	displacement	No Data Available
P13	velocity	E3
	displacement	E6
P14	velocity	No Data Available
	displacement	No Data Available
P15	velocity	E3
	displacement	E6
P16	velocity	E3
	displacement	E6

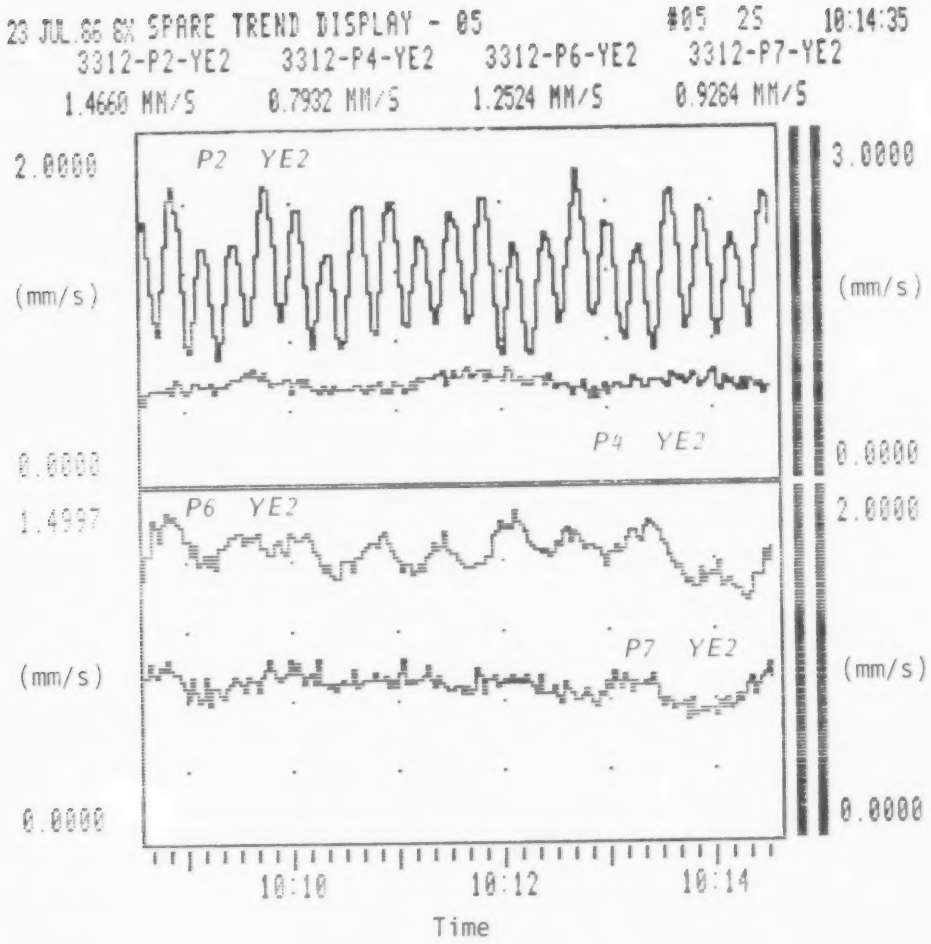


FIGURE E1

PHT CIRCULATING PUMPSETS VIBRATION VELOCITY AGAINST TIME AT FULL UNIT LOAD

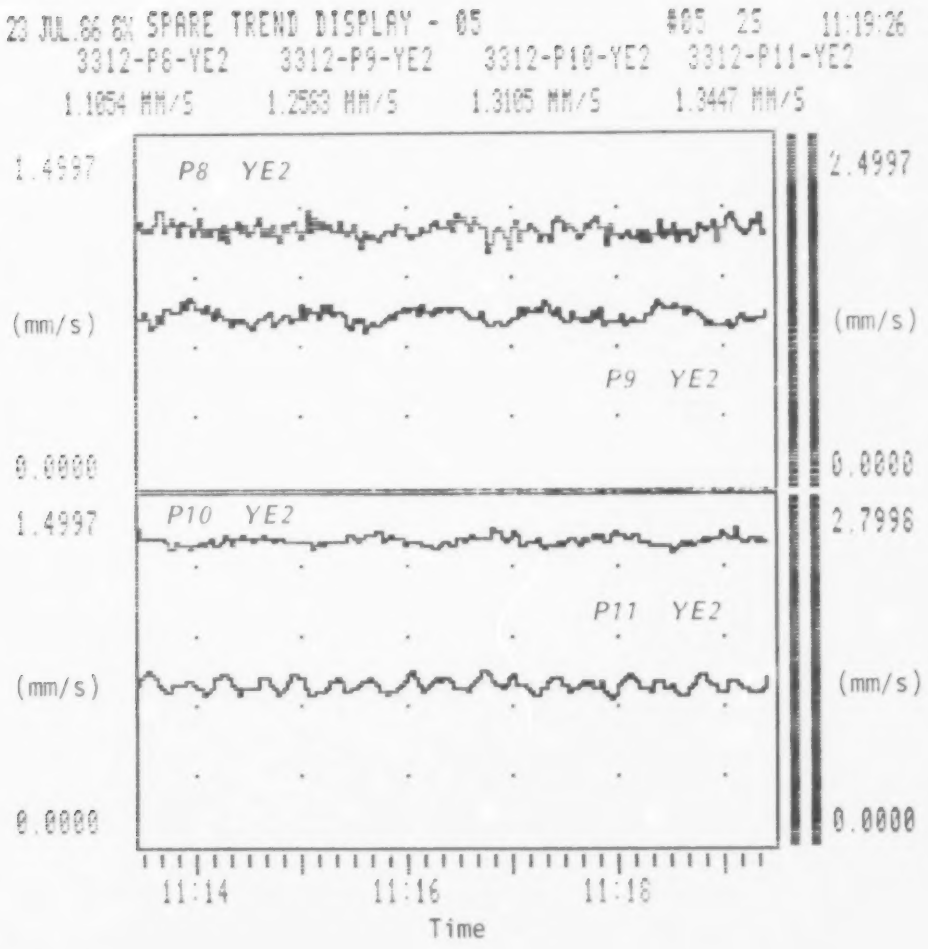


FIGURE E2

PHT CIRCULATING PUMPSETS VIBRATION VELOCITY AGAINST TIME AT FULL UNIT LOAD

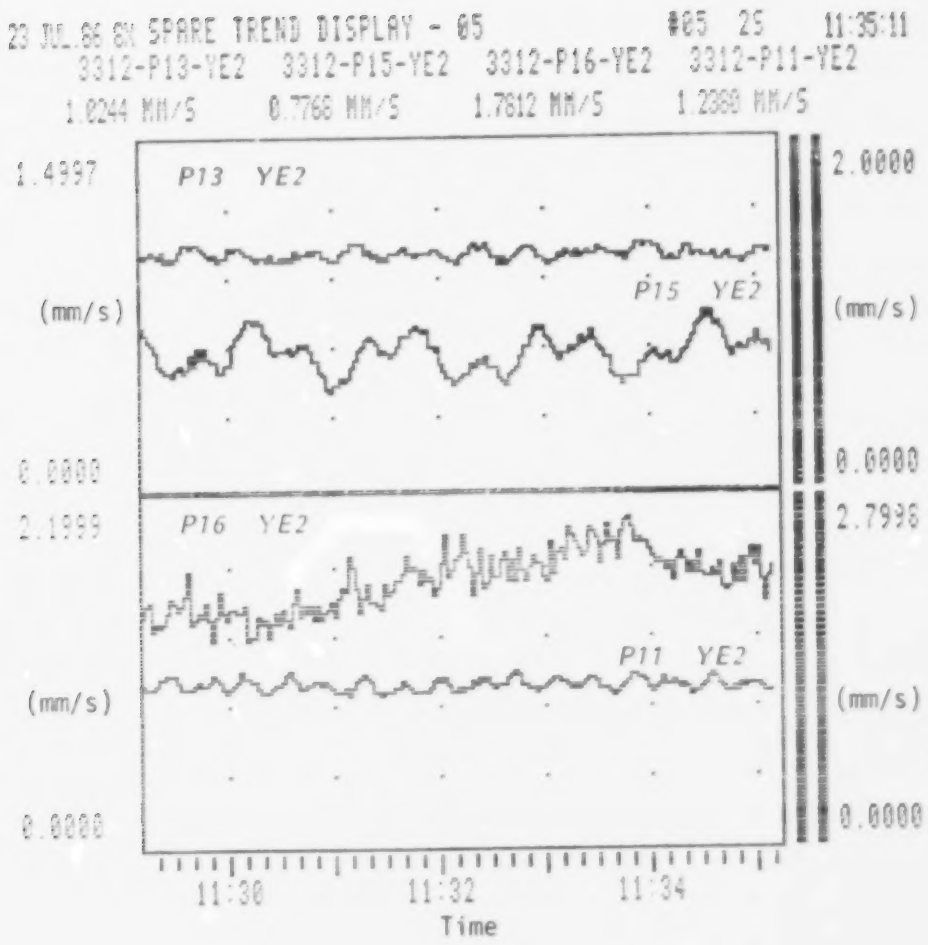


FIGURE E3

PHT CIRCULATING PUMPSETS VIBRATION VELOCITY AGAINST TIME AT FULL UNIT LOAD

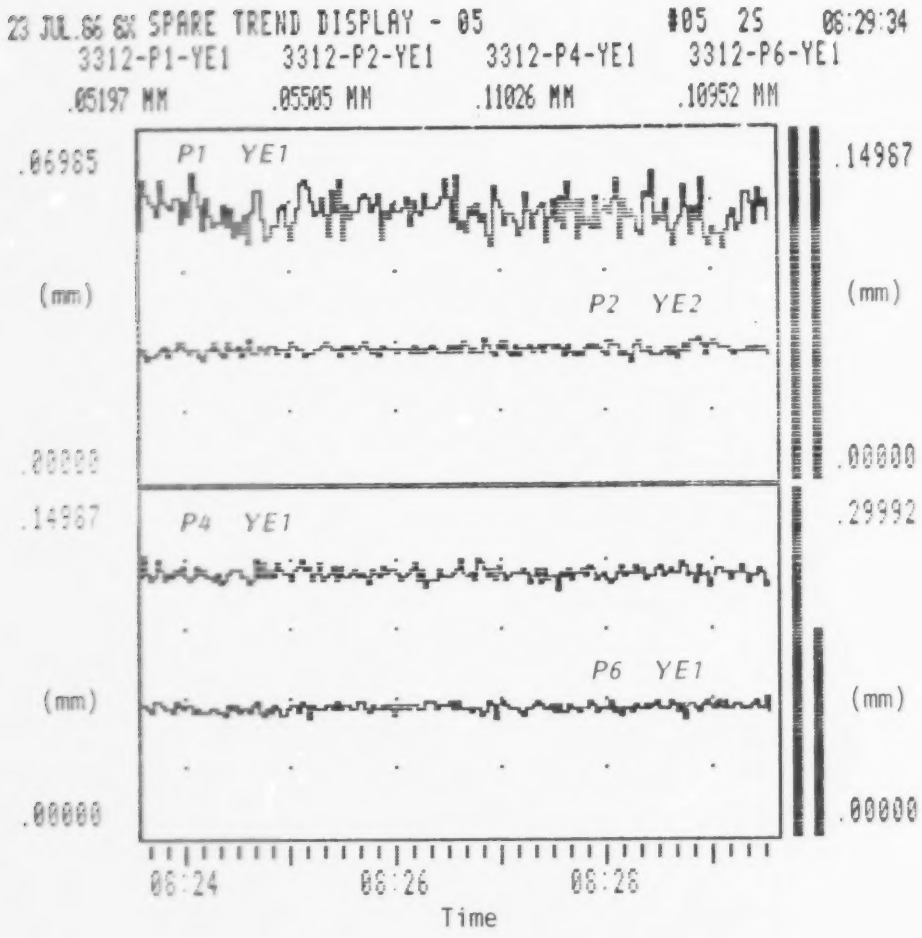


FIGURE E4

PHT CIRCULATING PUMPSETS SHAFT DISPLACEMENT (RUNOUT) AGAINST TIME AT FULL UNIT LOAD

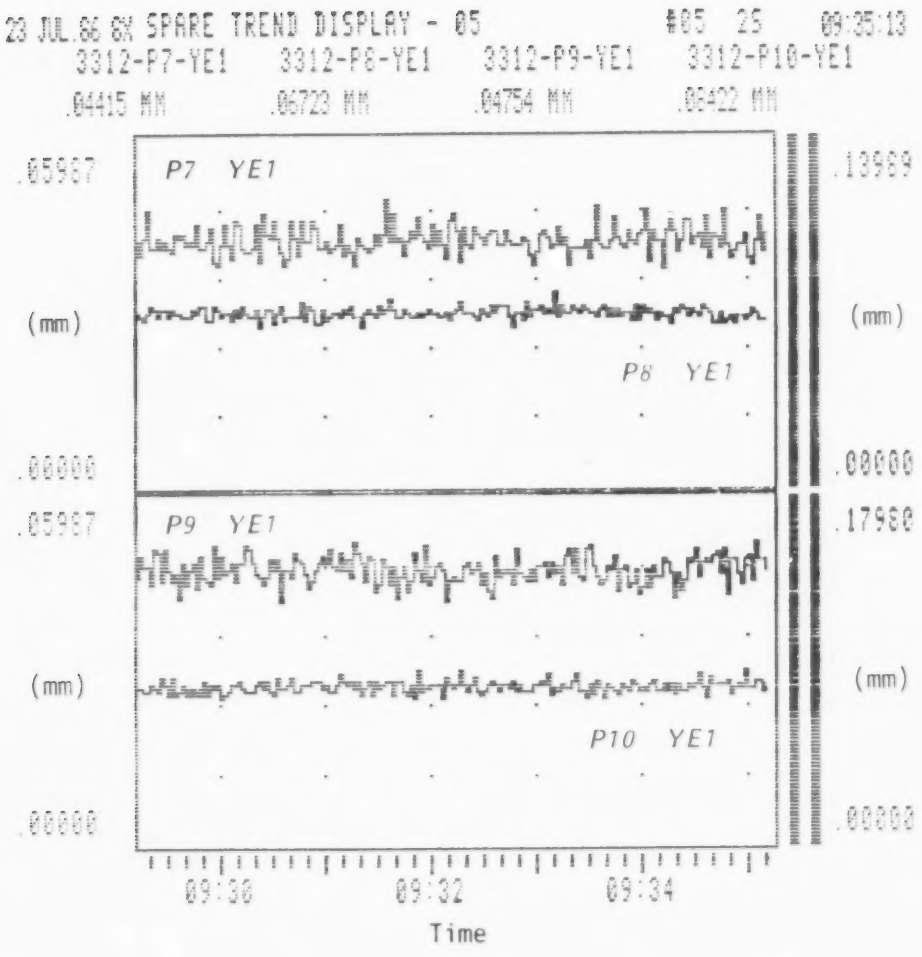


FIGURE E5

PHT CIRCULATING PUMPSETS SHAFT DISPLACEMENT (RUNOUT) AGAINST TIME AT FULL UNIT LOAD

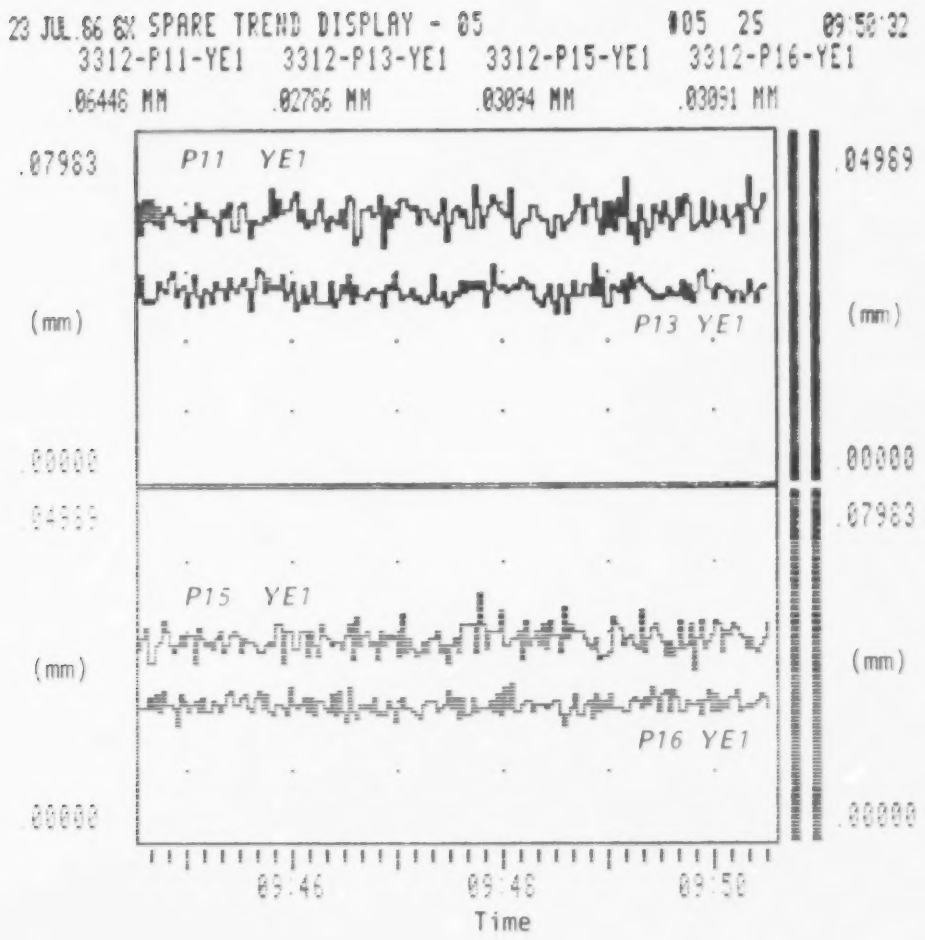


FIGURE E6

PHT CIRCULATING PUMPSETS SHAFT DISPLACEMENT (RUNOUT) AGAINST TIME AT FULL UNIT LOAD

APPENDIX F

PHT CIRCULATING PUMPSETS - VIBRATION VELOCITY AND SHAFT DISCPLACEMENT (RUNOUT) SPECTRA AT FULL UNIT LOAD

Pump No	Frequency Range Hz	Figure
1	1-200 velocity	F1
	1-500 velocity	F2
	1-200 displacement	F3
	1-500 displacement	F4
2	1-200 velocity	F5
	1-500 velocity	F6
	1-200 displacement	F7
	1-500 displacement	F8
3	NO DATA AVAILABLE	
4	1-200 velocity	F9
	1-500 velocity	F10
	1-200 displacement	F11
	1-500 displacement	F12
5	NO DATA AVAILABLE	
6	1-200 velocity	F13
	1-500 velocity	F14
	1-200 displacement	F15
	1-500 displacement	F16
7	1-200 velocity	F17
	1-500 velocity	F18
	1-200 displacement	F19
	1-500 displacement	F20
8	1-200 velocity	F21
	1-500 velocity	F22
	1-200 displacement	F23
	1-500 displacement	F24
9	1-200 velocity	F25
	1-500 velocity	F26
	1-200 displacement	F27
	1-500 displacement	F28
10	1-200 velocity	F29
	1-500 velocity	F30
	1-200 displacement	F31
	1-500 displacement	F32

Pump No	Frequency Range Hz	Figure
11	1-200 velocity	F33
	1-500 velocity	F34
	1-200 displacement	F35
	1-500 displacement	F36
12	NO DATA AVAILABLE	
13	1-200 velocity	F37
	1-500 velocity	F38
	1-200 displacement	F39
	1-500 displacement	F40
14	NO DATA AVAILABLE	
15	1-200 velocity	F41
	1-500 velocity	F42
	1-200 displacement	F43
	1-500 displacement	F44
16	1-200 velocity	F45
	1-500 velocity	F46
	1-200 displacement	F47
	1-500 displacement	F48

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#1
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	60	.6598
2	8.5	.1623
3	79.5	.1023
4	11.5	.08247
5	75	.07213
6	82	.06861
7	31	.06597
8	120	.06266
9	67.5	.05046
10	65.5	.0489
11	83.5	.0469
12	70	.03938
13	85.5	.03701
14	88.5	.03544
15	89.5	.03525
16	18.5	.02774
17	97	.0274
18	94	.02578
19	95	.0255
20	36.5	.02384

252.-03 V/EA 3.16+00 E VLG

C

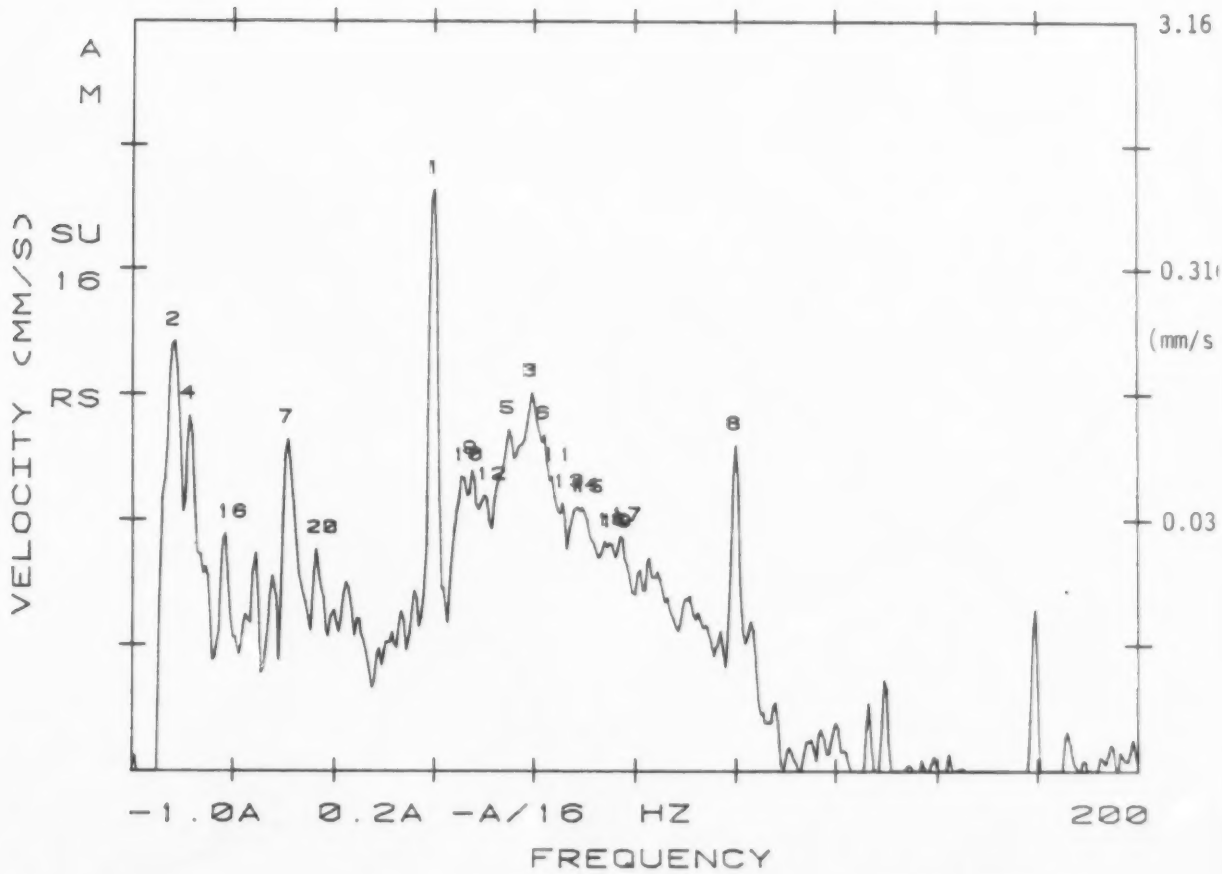


FIGURE F1

172742 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#1
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	60	.6937
2	8.75	.2013
3	80	.1277
4	70	.0817
5	31.25	.07523
6	120	.06157
7	90	.05518
8	298.75	.04646
9	97.5	.03787
10	102.5	.03421
11	18.75	.03407
12	238.75	.0298
13	36.25	.02869
14	106.25	.02854
15	358.75	.02737
16	42.5	.02653
17	111.25	.02397
18	23.75	.02358
19	376.25	.01762
20	243.75	.01645

252.-03 V/EA 3.16+00 E VLG

C

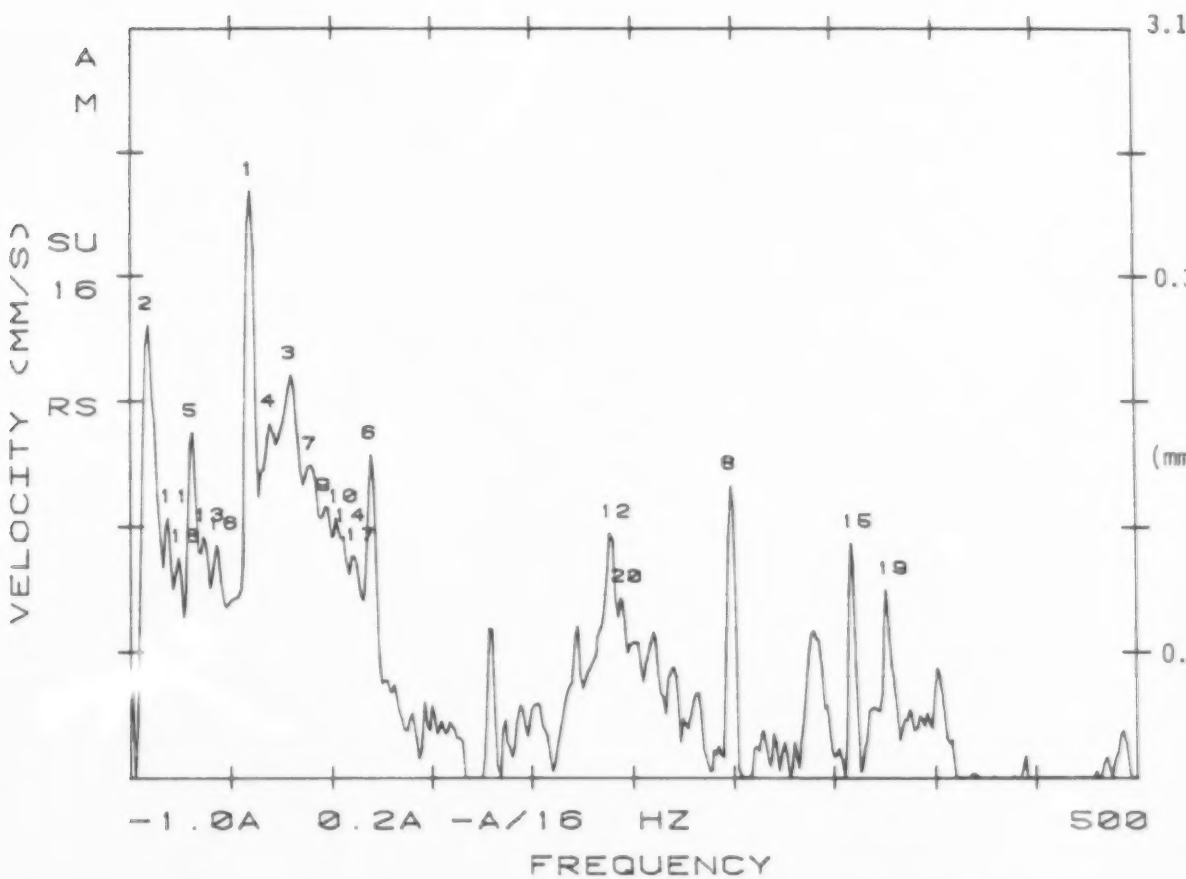


FIGURE F2

172743 RI

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#1
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.03676
2	12.5	.02216
3	140.5	.01187
4	60	.01087
5	9	6.777E-03
6	23	6.472E-03
7	19	6.308E-03
8	20.5	6.057E-03
9	25	5.405E-03
10	4	5.370E-03
11	5	5.233E-03
12	8.5	5.024E-03
13	17	4.695E-03
14	16	4.683E-03
15	27	4.619E-03
16	32	4.084E-03
17	89.5	3.959E-03
18	110.5	3.548E-03
19	36	3.453E-03
20	34	3.384E-03

4.72+00 V/EA 100.-03 E VLG

C

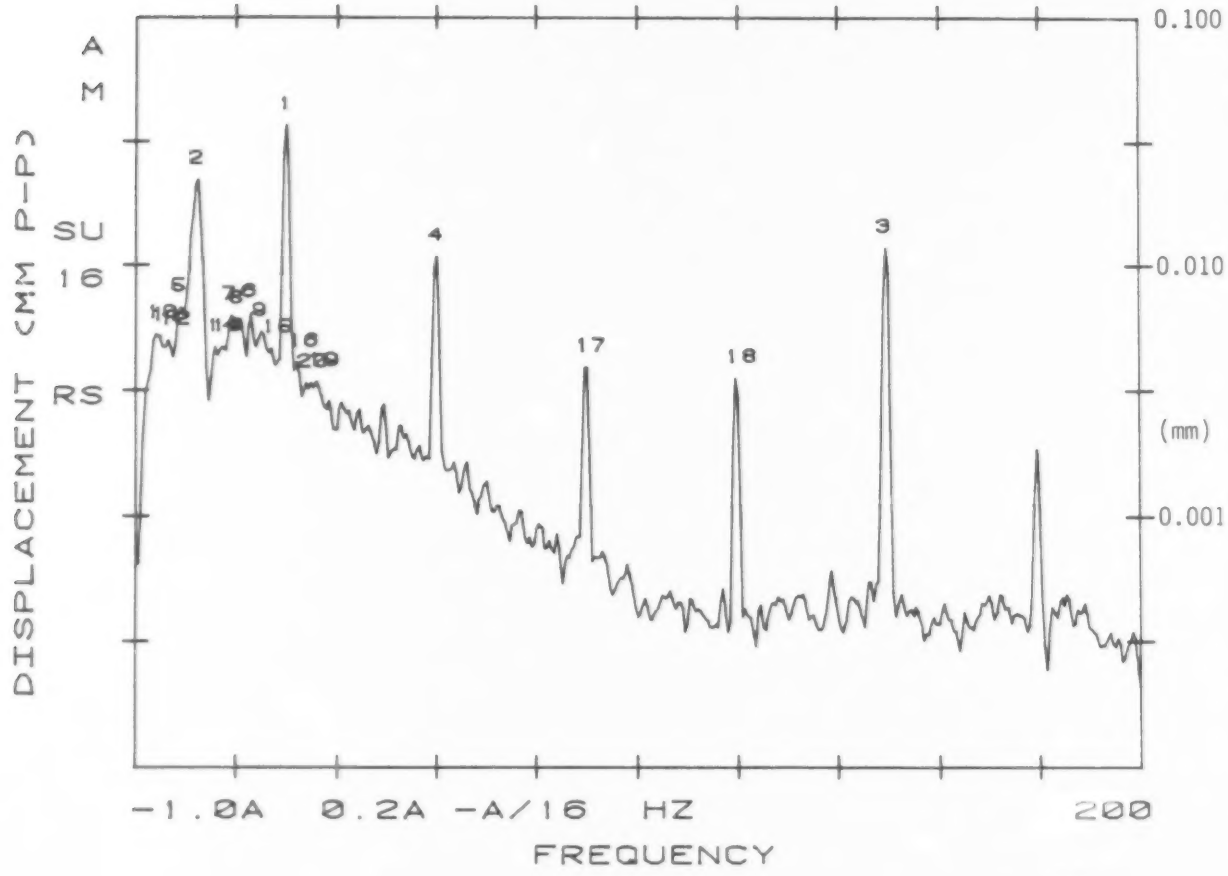


FIGURE F3

172789 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#1
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.03797
2	11.25	.02231
3	150	.01189
4	60	.01166
5	6.25	9.754E-03
6	3.75	9.701E-03
7	18.75	9.054E-03
8	16.25	8.968E-03
9	41.25	4.496E-03
10	90	4.49E-03
11	48.75	3.771E-03
12	52.5	3.655E-03
13	120	3.519E-03
14	418.75	2.529E-03
15	238.75	2.31E-03
16	448.75	2.182E-03
17	68.25	2.153E-03
18	70	2.121E-03
19	210	1.924E-03
20	388.75	1.919E-03

4.72+00 V/EA 100.-03 E VLG

C

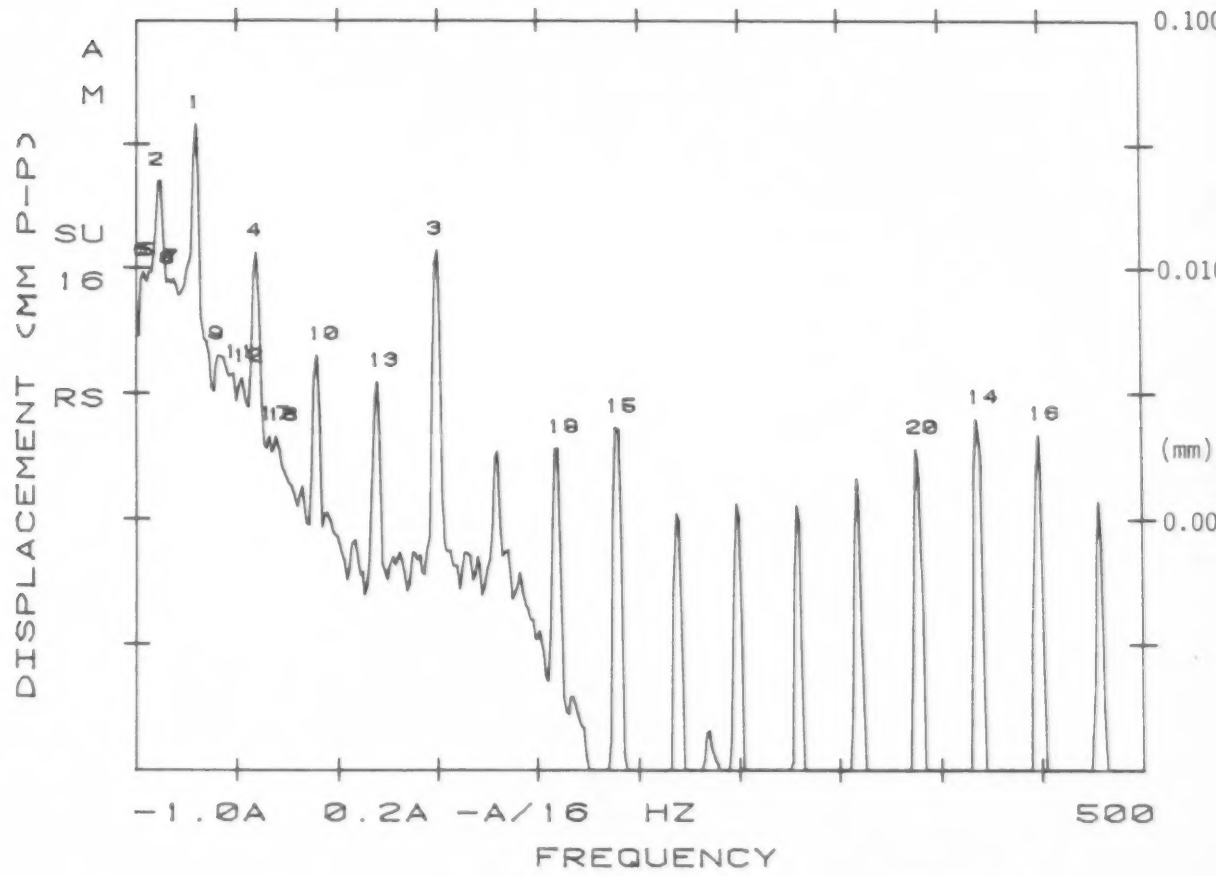


FIGURE F4

172744 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#2
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	149.5	1.067
2	30	.4749
3	20.5	.1681
4	25	.1148
5	60	.1108
6	4.5	.08203
7	119.5	.07697
8	33.5	.07553
9	27.5	.06768
10	18	.0675
11	38.5	.06429
12	16	.06033
13	143	.05993
14	144	.05646
15	10	.05163
16	145.5	.05163
17	6	.05094
18	147	.04871
19	63	.04449
20	71.5	.04019

252.-03 V/EA 3.16+00 E VLG

C

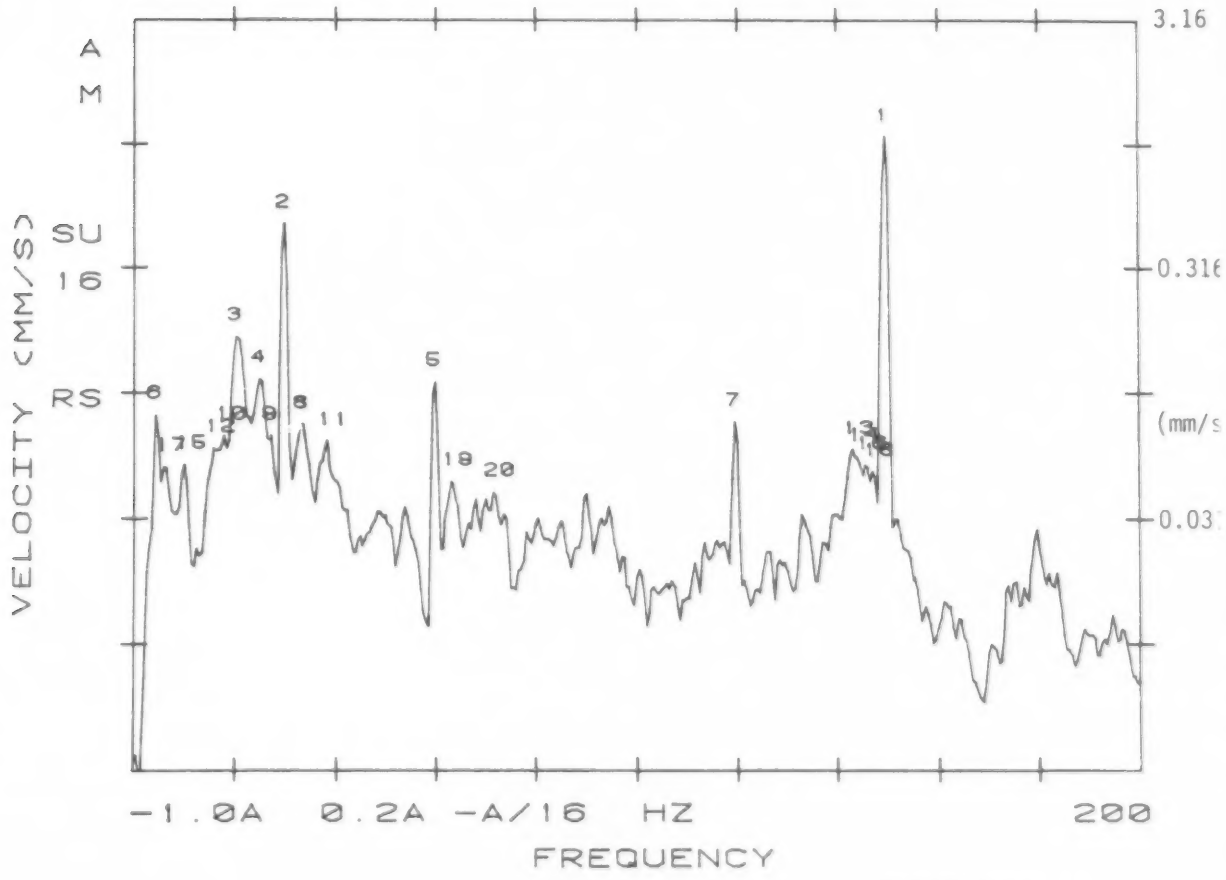


FIGURE F5

172745 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#2
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	150	1.022
2	30	.3707
3	20	.2151
4	25	.1544
5	10.25	.1036
6	120	.08801
7	5	.07771
8	80	.07719
9	40	.07155
10	10	.06926
11	63.75	.06926
12	143.75	.06677
13	71.25	.06042
14	53.75	.05833
15	93.75	.05241
16	133.75	.05053
17	90	.04819
18	46.25	.0454
19	81.25	.04243
20	77.5	.03849

252.-03 V/EA 3.16+00 E VLG

C

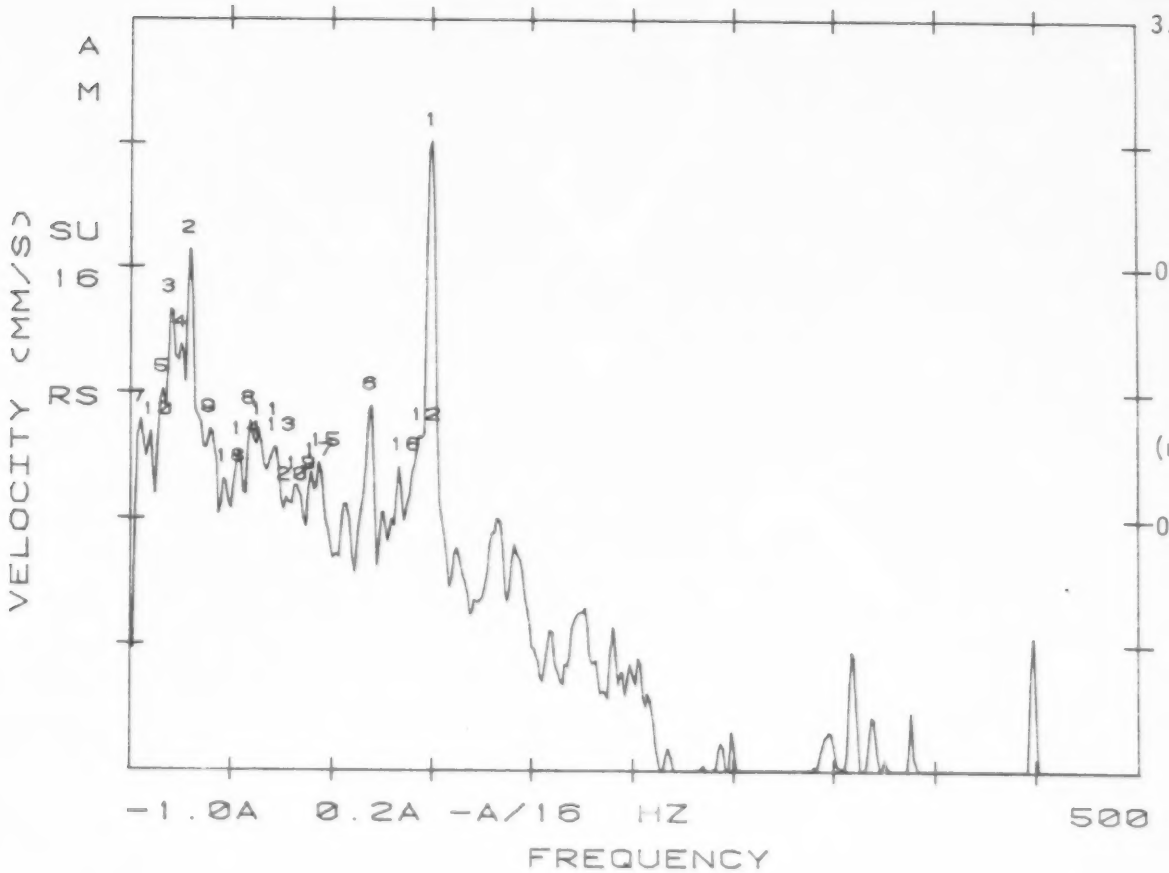


FIGURE F5

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#2
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.04925
2	60	.01429
3	89.5	8.872E-03
4	179.5	6.935E-03
5	149.5	5.895E-03
6	119.5	5.413E-03
7	16.5	5.113E-03
8	14.5	4.472E-03
9	12	3.567E-03
10	21	3.402E-03
11	32	3.214E-03
12	23.5	3.103E-03
13	10.5	2.706E-03
14	26.5	2.702E-03
15	34.5	2.522E-03
16	3.5	2.502E-03
17	37	2.490E-03
18	5.5	2.445E-03
19	44	2.263E-03
20	39.5	2.203E-03

4.72+00 V/EA 316.-03 E VLG

C

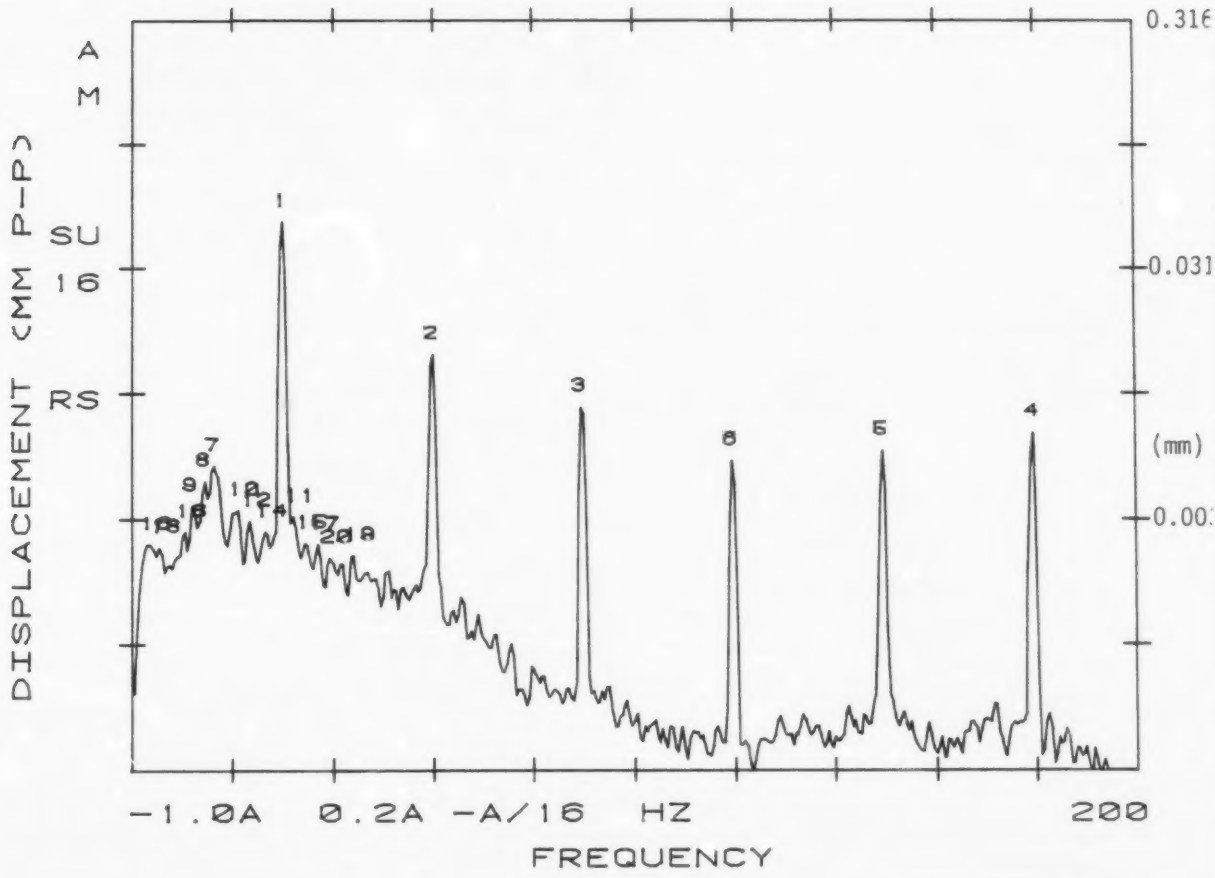


FIGURE F7

172747 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#2
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.05020
2	60	.01554
3	90	8.872E-03
4	15	7.4E-03
5	180	6.472E-03
6	150	5.847E-03
7	120	5.225E-03
8	23.75	4.040E-03
9	3.75	3.916E-03
10	238.75	3.616E-03
11	208.75	3.611E-03
12	358.75	3.444E-03
13	45	3.352E-03
14	40	3.240E-03
15	48.75	2.971E-03
16	52.5	2.796E-03
17	388.75	2.468E-03
18	478.75	2.09E-03
19	71.25	1.910E-03
20	298.75	1.660E-03

4.72+00 V/EA 316.-03 E VLG

C

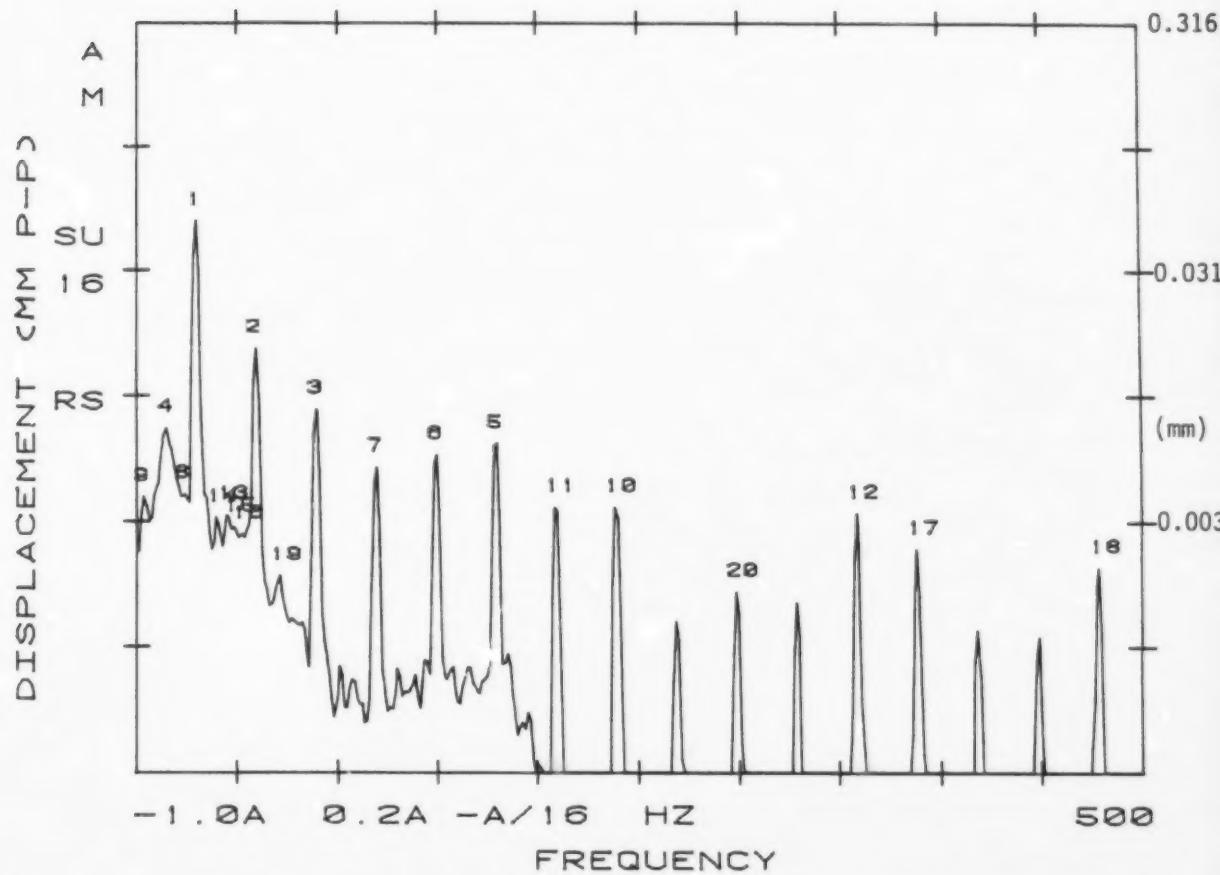


FIGURE F8

172748 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#4
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.7274
2	149.5	.1523
3	3.5	.1277
4	19	.1134
5	17	.08826
6	23.5	.08104
7	21.5	.07645
8	14.5	.07594
9	24.5	.07213
10	10	.06351
11	6	.06132
12	27.5	.05646
13	80.5	.05206
14	120	.04925
15	60	.03777
16	32.5	.03766
17	64.5	.03621
18	68.5	.03421
19	186.5	.03366
20	70	.03361

252.-03 V/EA 3.16+00 E VLG

C

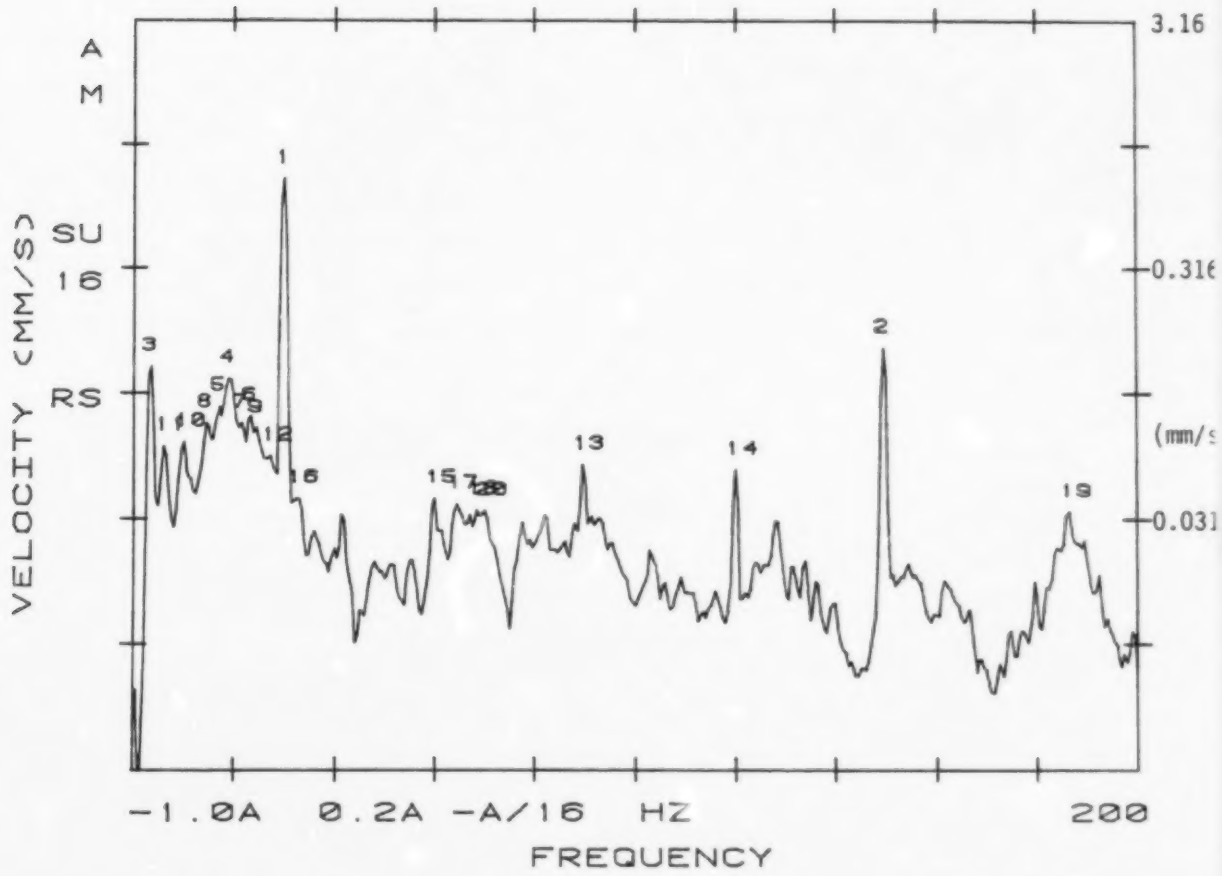


FIGURE F9

172749 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#4
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.7555
2	18.75	.1556
3	150	.1356
4	3.75	.1167
5	13.75	.1048
6	60	.06091
7	90	.0588
8	187.5	.05625
9	68.75	.0548
10	120	.05473
11	86.25	.05392
12	41.25	.03891
13	50	.03695
14	82.5	.03544
15	97.5	.03544
16	77.5	.03496
17	55	.03468
18	103.75	.03393
19	128.75	.03393
20	110	.02964

252.-03 V/EA 3.16+00 E VLG

C

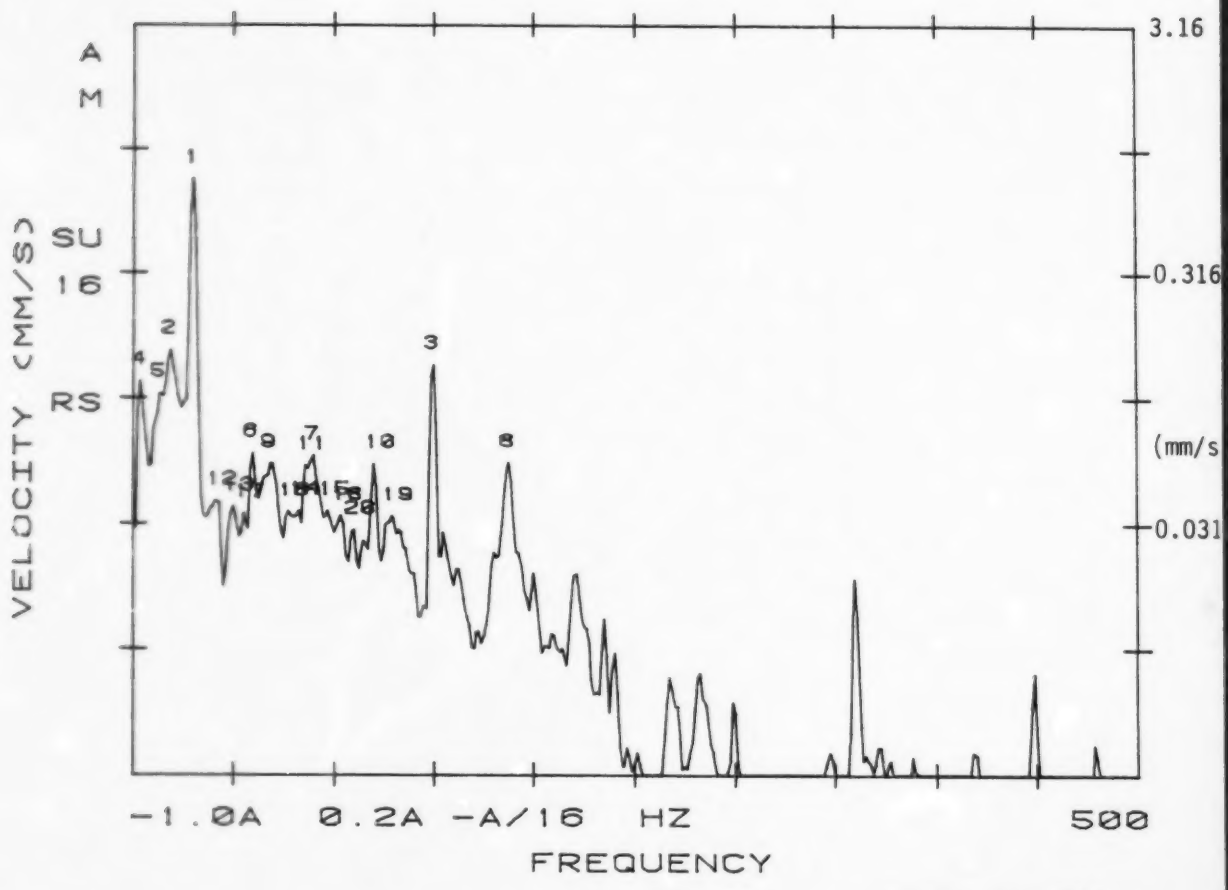


FIGURE F10

172750 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#4
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.1038
2	60	.01484
3	149.5	.01018
4	119.5	7.982E-03
5	14	6.65E-03
6	18.5	5.871E-03
7	179.5	5.486E-03
8	20	5.155E-03
9	18.5	5.024E-03
10	89.5	4.844E-03
11	23	4.406E-03
12	25.5	3.989E-03
13	27.5	3.869E-03
14	11	3.771E-03
15	3.5	3.705E-03
16	5	3.675E-03
17	34	3.258E-03
18	8	3.223E-03
19	32	3.095E-03
20	39.5	2.845E-03

4.72+00 V/EA 316.-03 E VLG

C

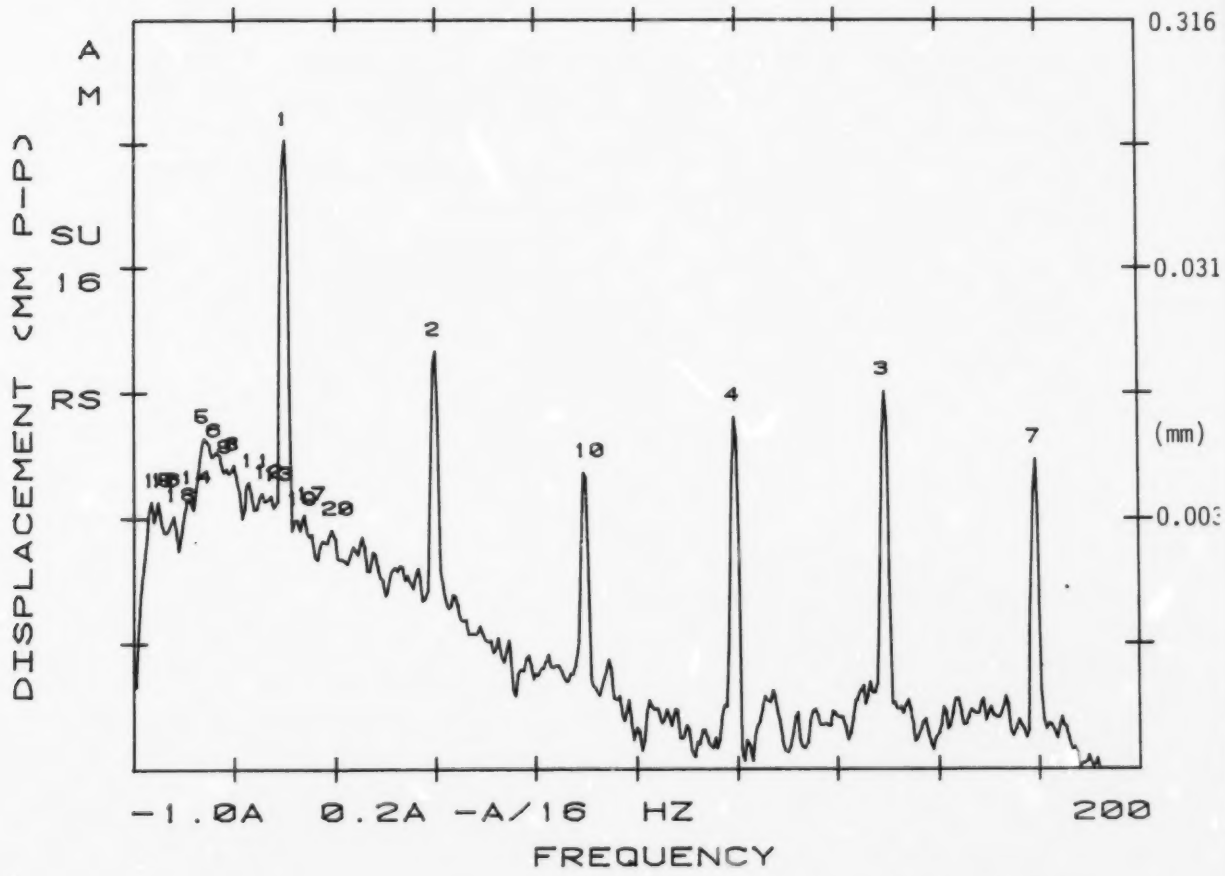


FIGURE F11

172751 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#4
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.1073
2	60	.01478
3	150	.01001
4	15	9.954E-03
5	17.5	9.913E-03
6	120	7.655E-03
7	35	5.63E-03
8	3.75	5.464E-03
9	298.75	5.398E-03
10	90	5.376E-03
11	180	5.169E-03
12	8.25	4.99E-03
13	208.75	4.727E-03
14	238.75	4.645E-03
15	388.75	4.632E-03
16	40	4.145E-03
17	268.75	3.817E-03
18	50	3.095E-03
19	328.75	3.045E-03
20	46.25	2.815E-03

4.72+00 V/EA 316.-03 E VLG

C

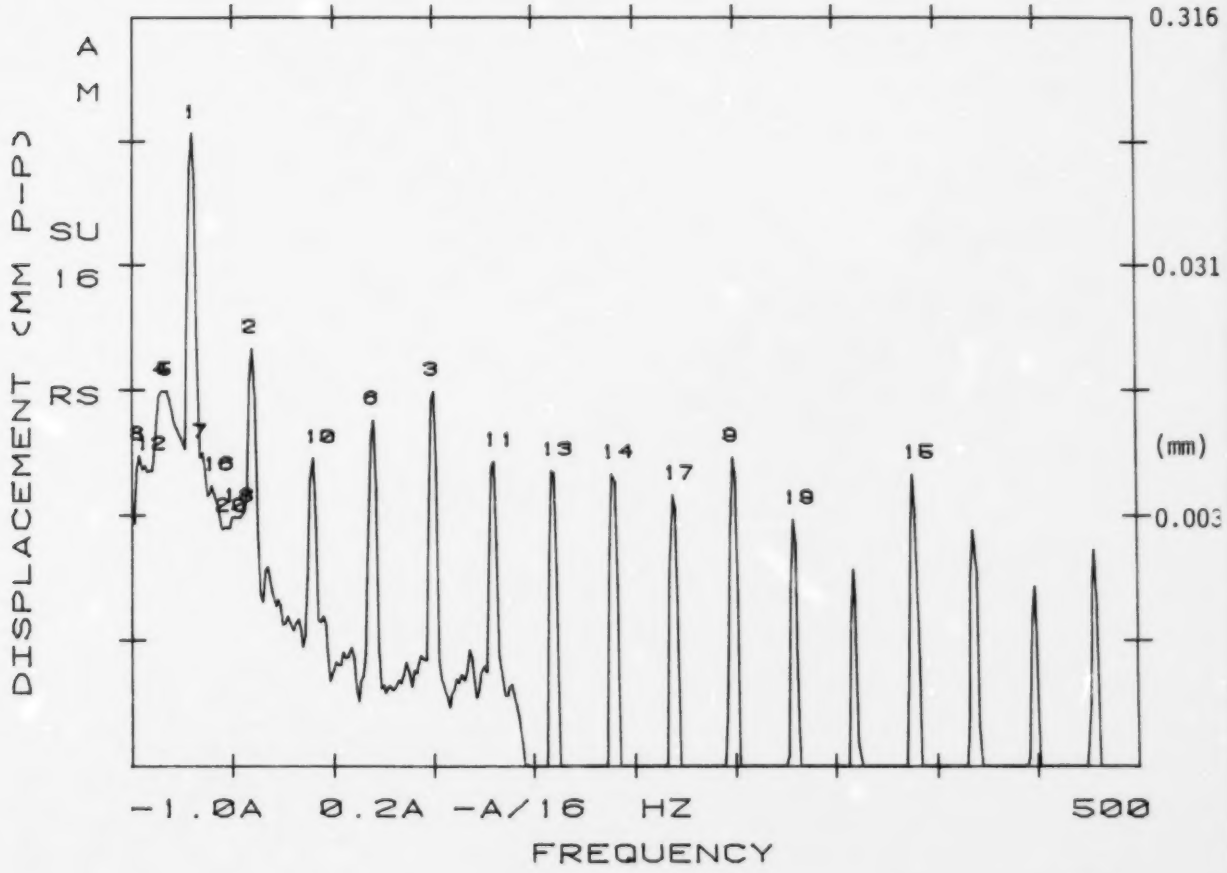


FIGURE F12

172752 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#6
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.5647
2	149.5	.4801
3	6	.1647
4	60	.1439
5	38.5	.106
6	21.5	.1034
7	12.5	.08578
8	32.5	.08543
9	10	.07963
10	64.5	.07411
11	26.5	.07361
12	15	.07311
13	66.5	.06935
14	40.5	.06851
15	54.5	.06099
16	96	.06099
17	119.5	.05801
18	34.5	.05731
19	93.5	.05518
20	69.5	.05363

252.-03 V/EA 3.16+00 E VLG

C

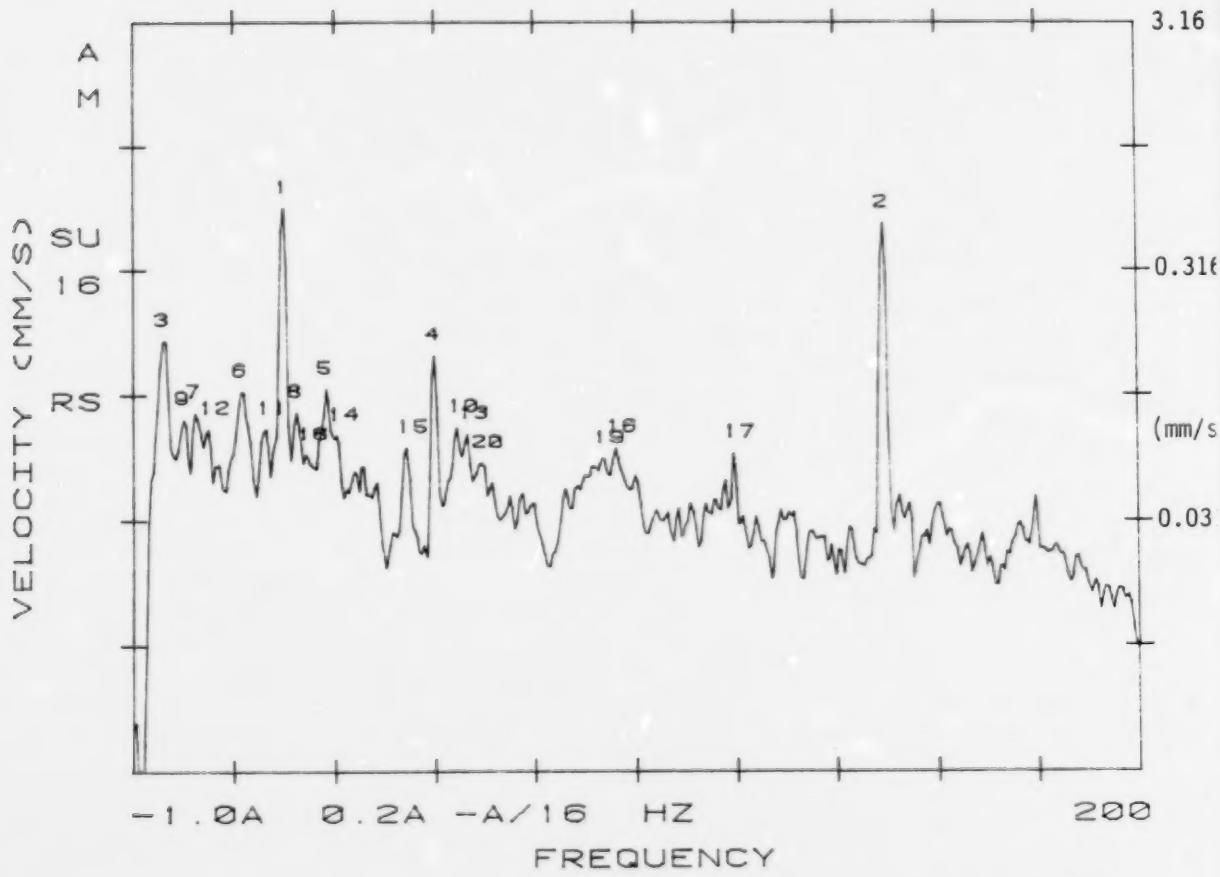


FIGURE F13

172753 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#6
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.5825
2	150	.2789
3	60	.2046
4	6.25	.1567
5	22.5	.1531
6	38.75	.137
7	11.25	.1231
8	66.25	.1044
9	46.25	.09875
10	92.5	.09521
11	88.75	.07963
12	98.75	.07803
13	55	.07213
14	78.75	.06945
15	118.75	.06491
16	128.75	.06091
17	138.75	.05241
18	106.25	.05191
19	158.75	.05184
20	153.75	.04852

252.-03 V/EA 3.16+00 E VLG

C

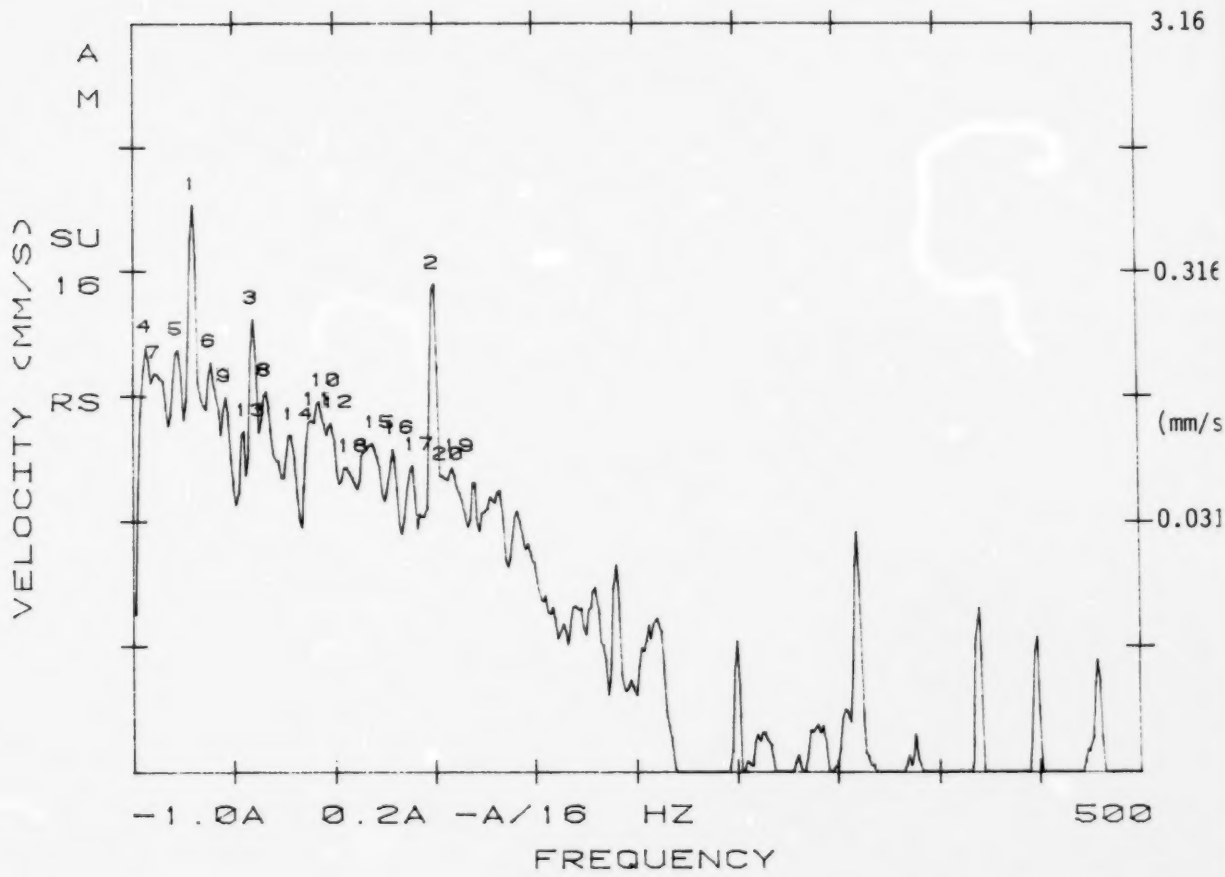


FIGURE F14

172754 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#6
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.102
2	60	.02419
3	89.5	8.404E-03
4	15	7.232E-03
5	12.5	6.832E-03
6	119.5	6.376E-03
7	149.5	6.214E-03
8	26.5	6.114E-03
9	20	5.668E-03
10	11	5.45E-03
11	23	5.42E-03
12	33	4.601E-03
13	4.5	4.533E-03
14	37.5	4.514E-03
15	179.5	4.335E-03
16	40	4.046E-03
17	43	4.002E-03
18	52.5	3.486E-03
19	48.5	3.302E-03
20	46.5	3.245E-03

4.72+00 V/EA 316.-03 E VLG

C

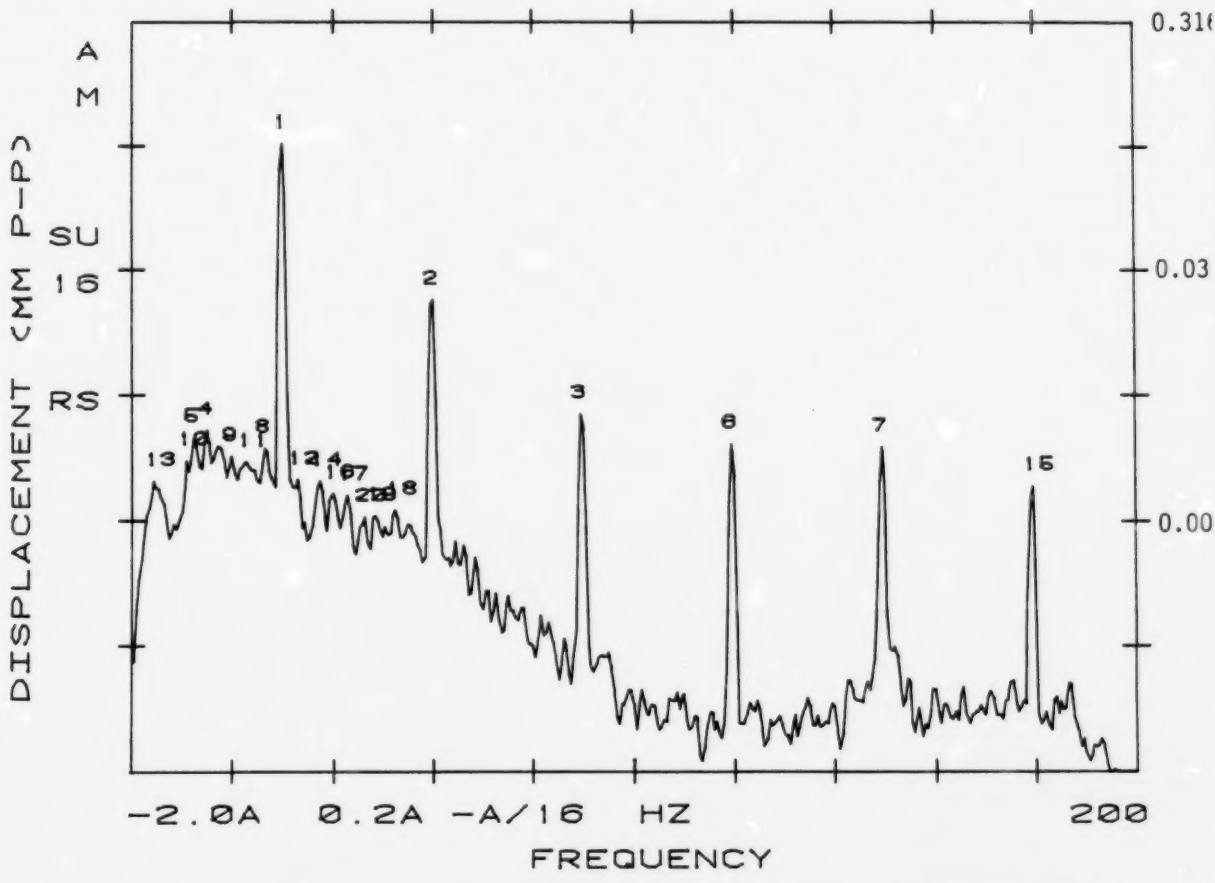


FIGURE F15

172755 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#6
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.1045
2	60	.02557
3	13.75	9.48E-03
4	90	8.611E-03
5	22.5	7.242E-03
6	150	6.49E-03
7	120	6.351E-03
8	48.25	6.156E-03
9	5	6.049E-03
10	51.25	4.689E-03
11	208.75	4.57E-03
12	388.75	4.134E-03
13	328.75	4.013E-03
14	178.75	3.781E-03
15	298.75	3.73E-03
16	358.75	3.496E-03
17	268.75	3.254E-03
18	78.75	2.338E-03
19	418.75	2.338E-03
20	238.75	1.575E-03

4.72+00 V/EA 316.-03 E VLG

C

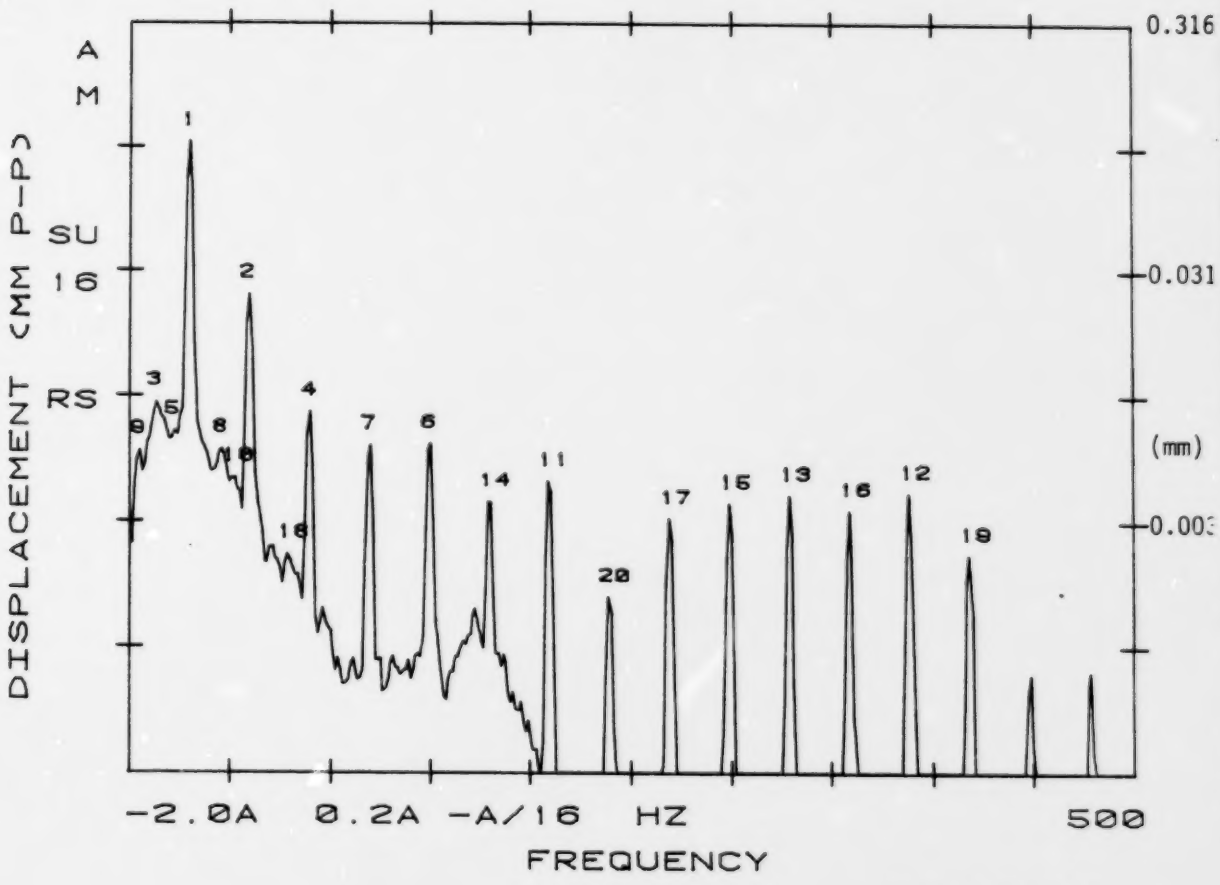


FIGURE F16

172756 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#7
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	149.5	.5357
2	30	.3367
3	39	.1838
4	6.5	.1381
5	25	.1178
6	22	.1101
7	119.5	.09547
8	10.5	.07645
9	45	.07523
10	67.5	.06249
11	55	.06233
12	156.5	.06124
13	60	.05993
14	179.5	.05985
15	178	.05928
16	12	.05864
17	74	.05685
18	64.5	.05525
19	47.5	.05458
20	184	.05451

252.-03 V/EA 3.16+00 E VLG

C

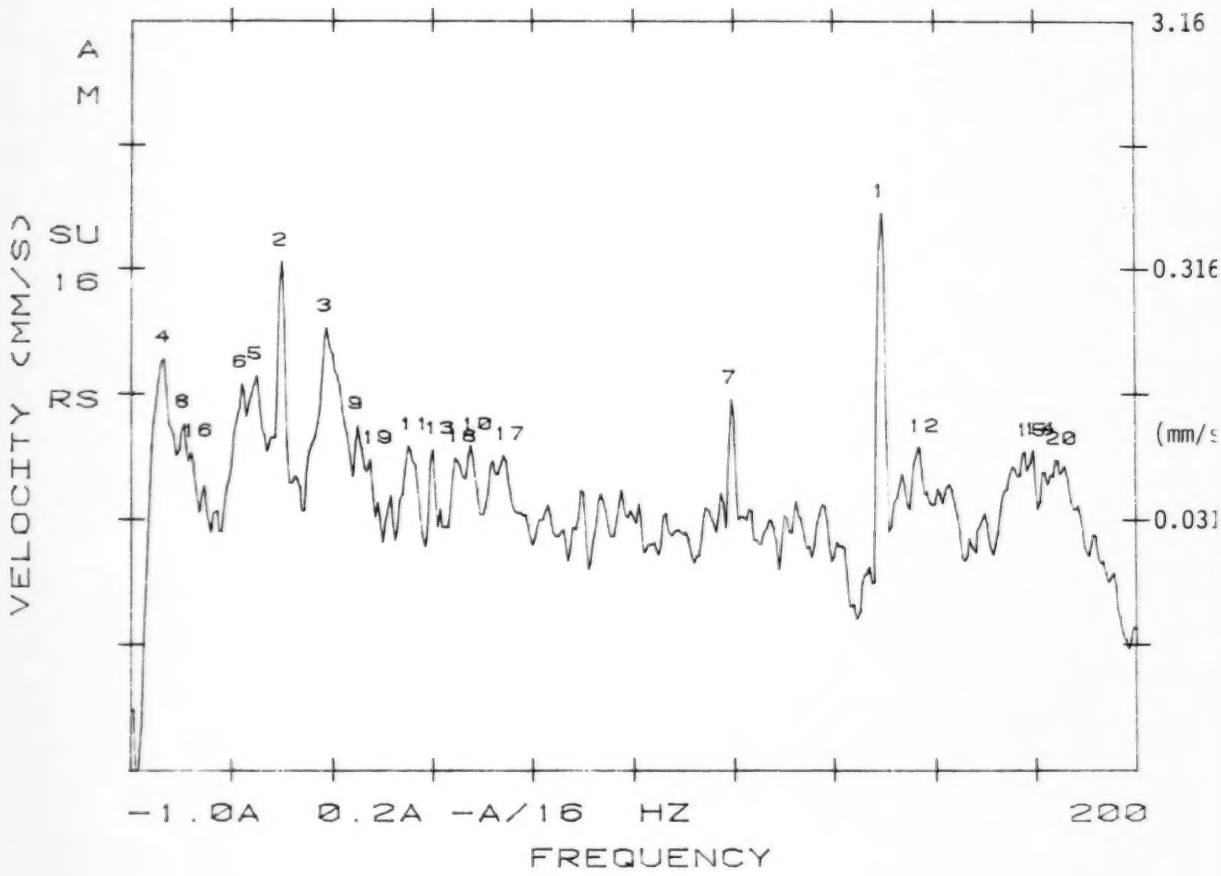


FIGURE F17

172757 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#7
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	150	.5437
2	30	.3803
3	38.75	.2094
4	6.25	.1789
5	10	.1251
6	72.5	.1101
7	45	.105
8	120	.1015
9	157.5	.08934
10	66.25	.0852
11	55	.08474
12	178.75	.08237
13	187.5	.0688
14	60	.06642
15	90	.06455
16	48.75	.06166
17	98.75	.06001
18	130	.05904
19	81.25	.05841
20	171.25	.0554

252.-03 V/EA 3.16+00 E VLG

C

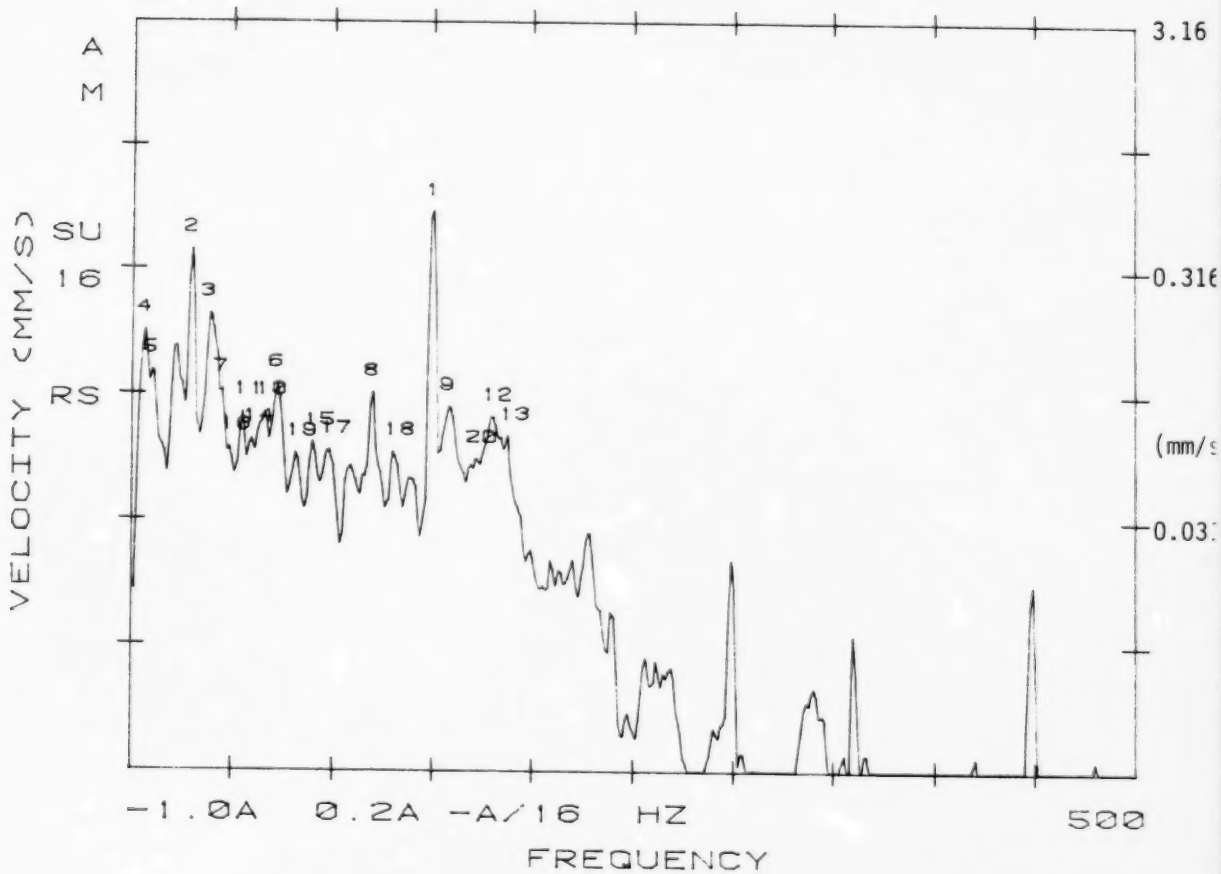


FIGURE F18

172758 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#7
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.02722
2	89.5	.01468
3	149.5	7.301E-03
4	60	7.039E-03
5	16	6.759E-03
6	13	6.686E-03
7	11	6.024E-03
8	119.5	5.106E-03
9	179.5	5.01E-03
10	32	4.645E-03
11	4.5	4.168E-03
12	34.5	4.079E-03
13	9	3.932E-03
14	22.5	3.529E-03
15	24	3.37E-03
16	42.5	3.307E-03
17	26	3.258E-03
18	21	3.24E-03
19	41	3.21E-03
20	3	3.045E-03

4.72+00 V/EA 100.-03 E VLG

C

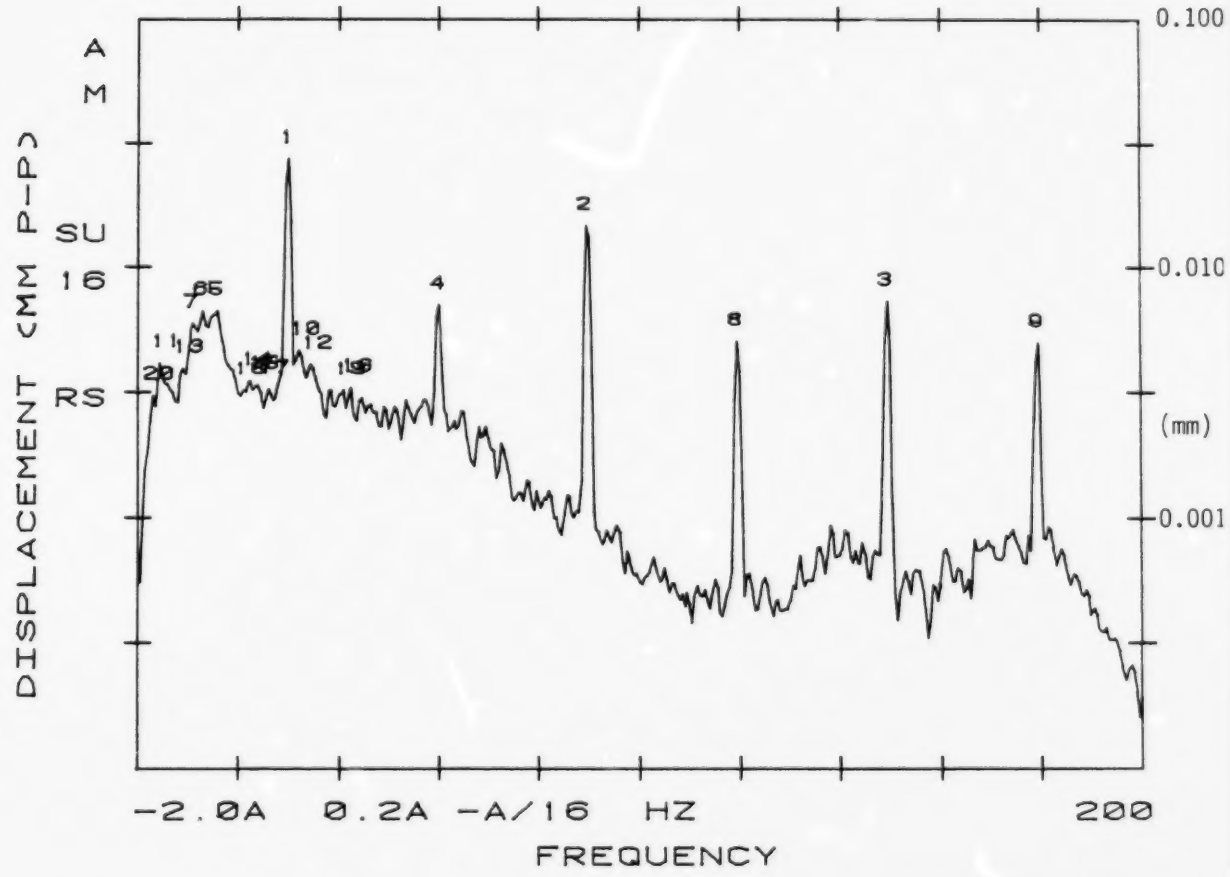


FIGURE F19

172759 RD

PICKERING NGS "B" UNIT#8
MAIN HEAT TRANSPORT PUMP#7
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.02944
2	90	.0149
3	13.75	.01265
4	60	7.501E-03
5	38.75	6.164E-03
6	5	6.016E-03
7	55	5.808E-03
8	20	5.524E-03
9	150	5.501E-03
10	238.75	5.479E-03
11	43.75	5.42E-03
12	208.75	5.296E-03
13	50	5.024E-03
14	120	4.857E-03
15	178.75	4.37E-03
16	65	3.766E-03
17	298.75	3.07E-03
18	73.75	2.634E-03
19	268.75	2.383E-03
20	478.75	2.059E-03

4.72+00 V/EA 100.-03 E VLG

C

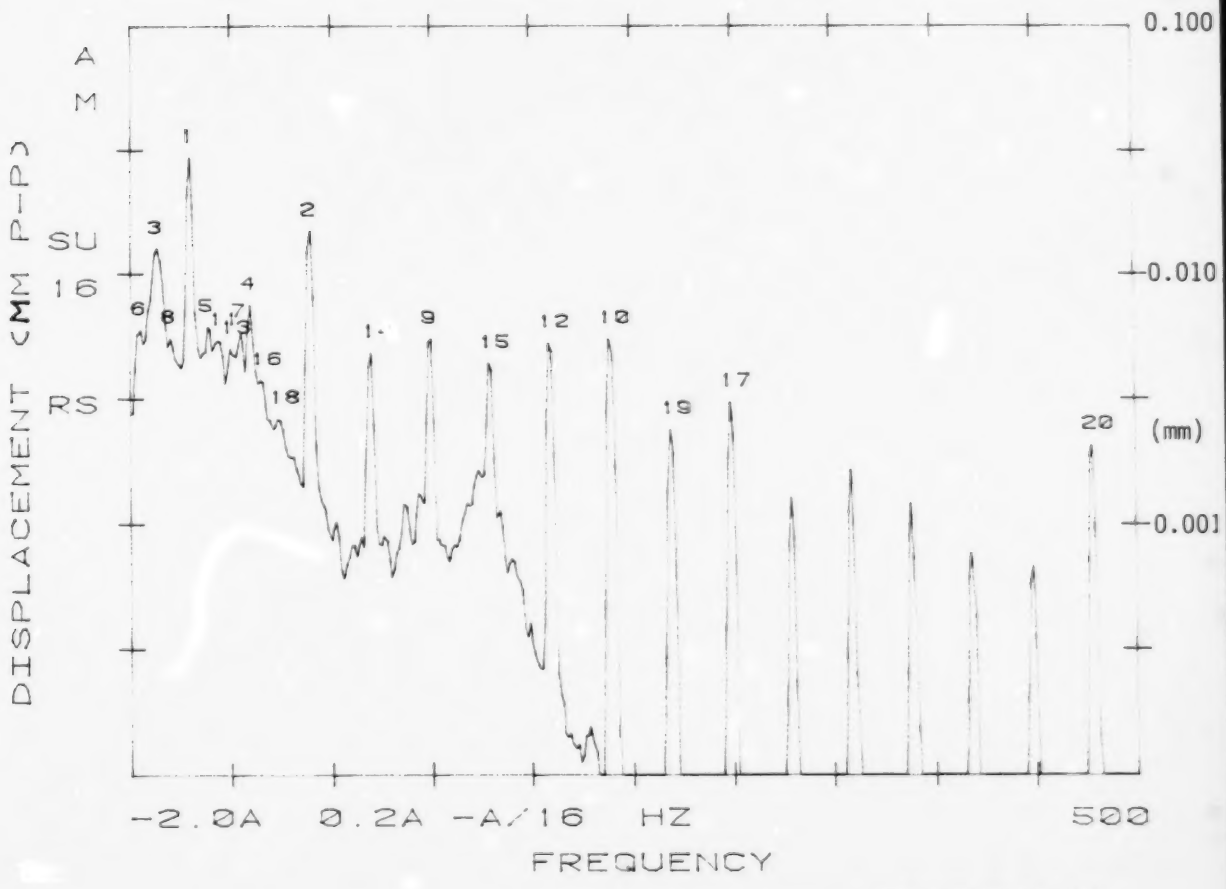


FIGURE F20

172760 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#8
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.3322
2	149.5	.08027
3	40	.04571
4	17	.03366
5	6	.03361
6	22	.03258
7	10	.02865
8	18.5	.02649
9	60	.02406
10	13	.02113
11	120	.02068
12	161.5	.01983
13	103.5	.01967
14	25.5	.01922
15	101.5	.0182
16	167.5	.0182
17	166.5	.01794
18	80	.01704
19	179.5	.01694
20	165	.01692

252.-03 V/EA 1.00+00 E VLG

C

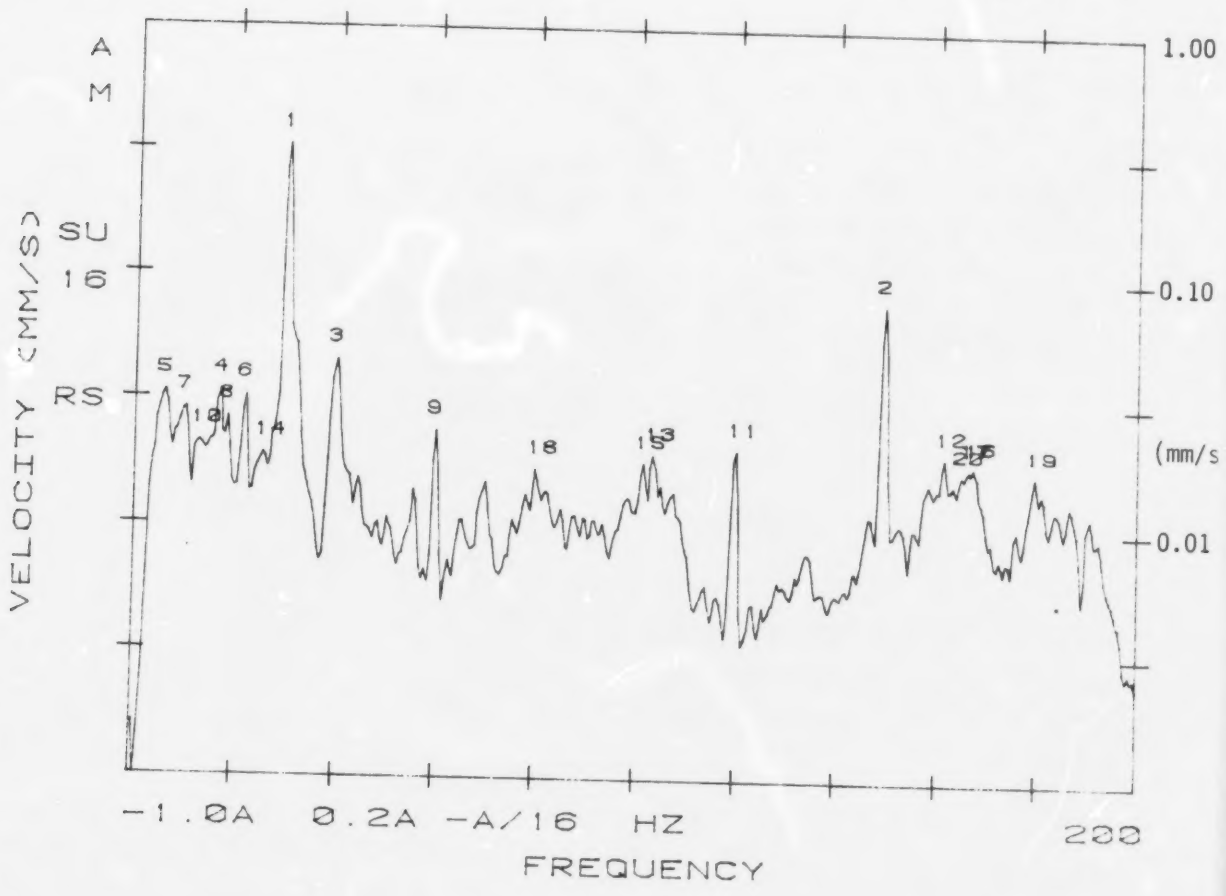


FIGURE F21

172761 RD

PICKERING NGS "B" UNIT#8
MAIN HEAT TRANSPORT PUMP#8
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.3353
2	150	.1593
3	40	.05227
4	17.5	.04491
5	11.25	.03864
6	5	.03771
7	21.25	.03444
8	101.25	.02952
9	162.5	.02819
10	180	.02533
11	80	.02456
12	105	.02342
13	120	.02216
14	56.25	.02082
15	60	.02021
16	153.75	.01811
17	93.75	.01808
18	170	.01784
19	48.75	.01753
20	70	.01741

252.-03 V/EA 1.00+00 E VLG C

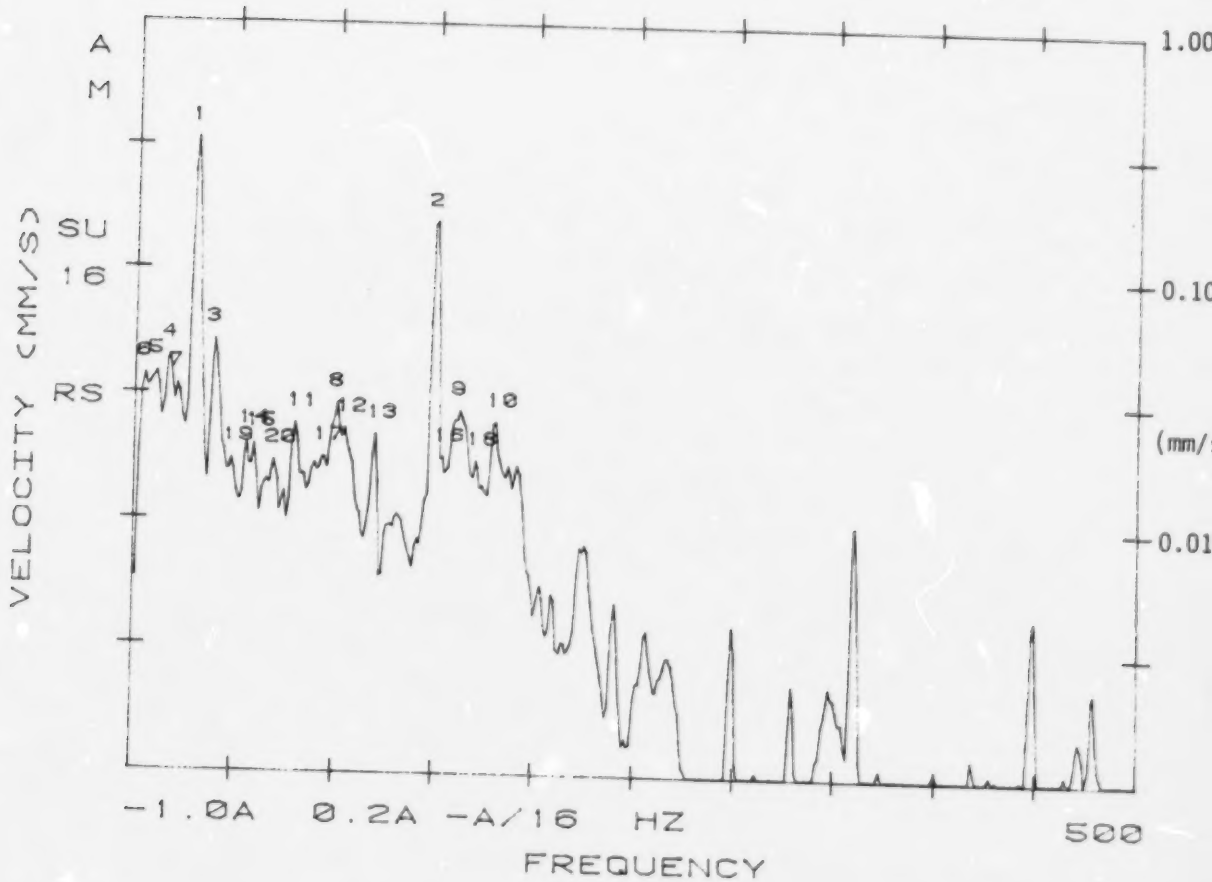


FIGURE F22

172762 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#8
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.06526
2	89.5	8.235E-03
3	149.5	6.972E-03
4	16.5	5.486E-03
5	11.5	4.484E-03
6	60	3.645E-03
7	28	3.449E-03
8	21.5	3.128E-03
9	36	3.103E-03
10	119.5	2.959E-03
11	179.5	2.736E-03
12	32.5	2.721E-03
13	34.5	2.699E-03
14	25.5	2.67E-03
15	44	2.567E-03
16	50	2.495E-03
17	3	2.475E-03
18	41.5	2.452E-03
19	37.5	2.37E-03
20	45.5	2.345E-03

4.72+00 V/EA 100.-03 E VLG

C

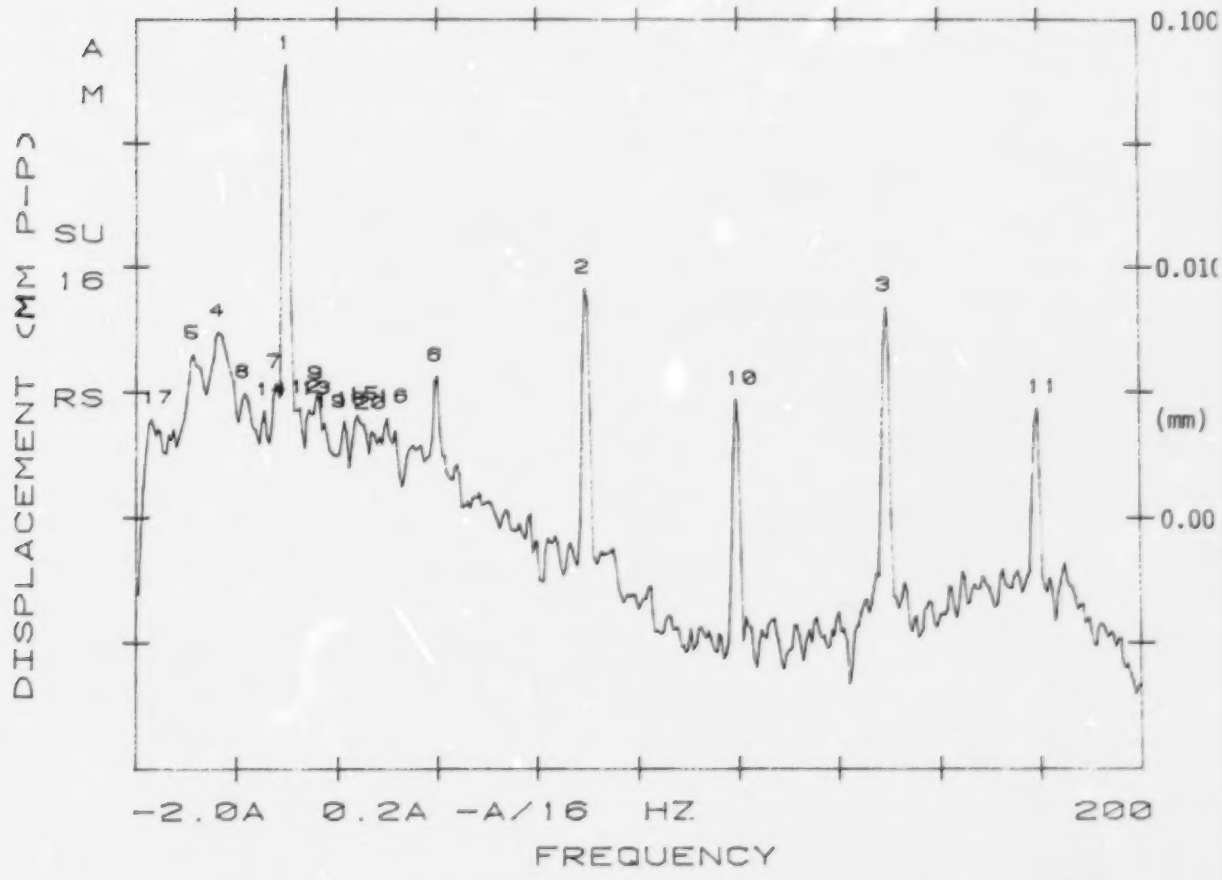


FIGURE F23

172763 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#8
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.06723
2	90	8.324E-03
3	150	7.728E-03
4	16.25	7.481E-03
5	60	4.943E-03
6	8.75	4.857E-03
7	36.25	4.714E-03
8	268.75	4.448E-03
9	3.75	4.282E-03
10	41.25	4.282E-03
11	51.25	3.948E-03
12	48.75	3.874E-03
13	358.75	3.402E-03
14	120	2.931E-03
15	178.75	2.688E-03
16	208.75	2.536E-03
17	67.5	2.218E-03
18	478.75	2.101E-03
19	388.75	2.053E-03
20	328.75	2.05E-03

4.72+00 V/EA 100.-03 E VLG

C

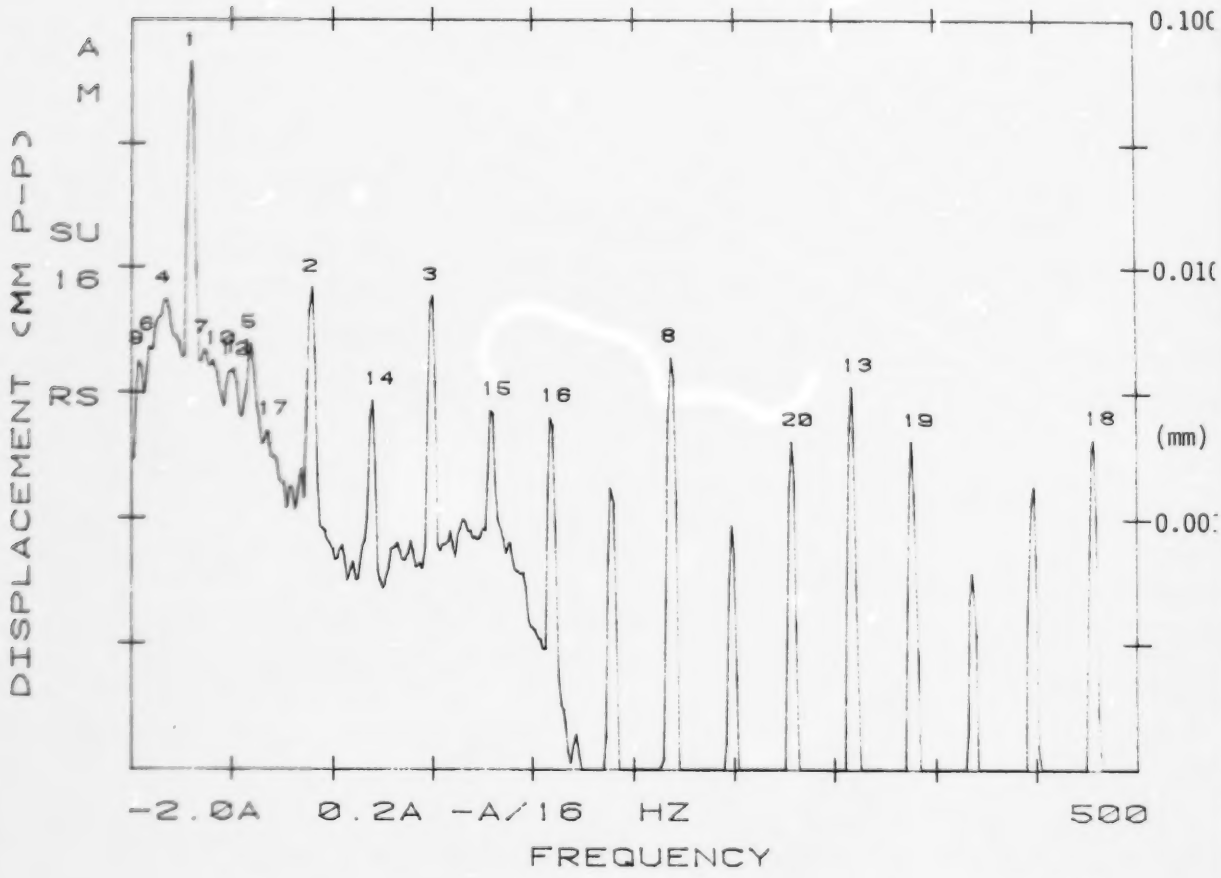


FIGURE F24

172764 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#9
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.9194
2	149.5	.2074
3	39	.1894
4	32.5	.1098
5	5.5	.102
6	60	.08555
7	3.5	.08147
8	16.5	.07563
9	26.5	.07462
10	10.5	.06842
11	21	.0605
12	184	.05715
13	190.5	.05715
14	24.5	.05473
15	19.5	.05378
16	13	.0506
17	182	.04787
18	100.5	.04754
19	104	.04697
20	186	.04621

83.6-03 V/EA 3.16+00 E VLG

C

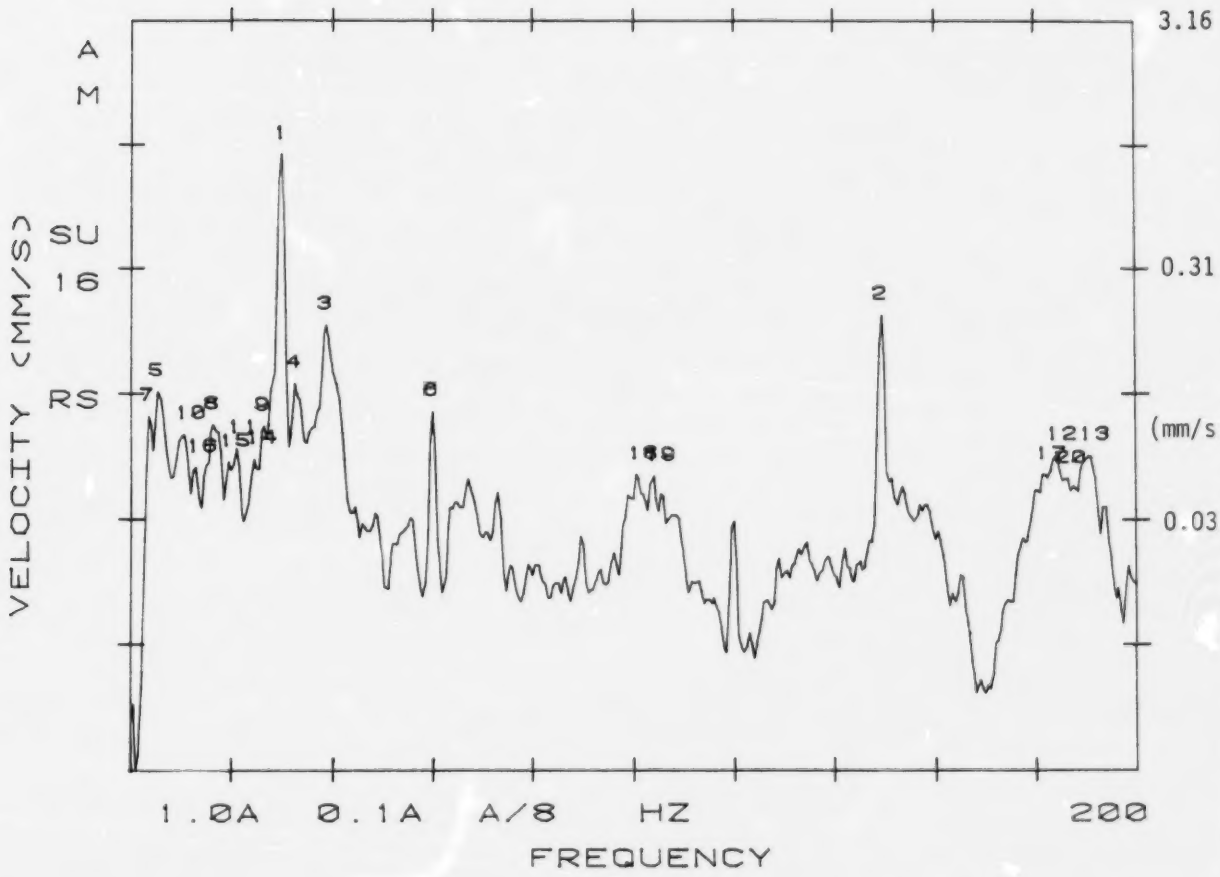


FIGURE F25

172765 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#9
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.9562
2	38.75	.2621
3	5	.1247
4	148.75	.1242
5	16.25	.09586
6	60	.09167
7	183.75	.08777
8	10	.08613
9	21.25	.08147
10	101.25	.07781
11	190	.07301
12	67.5	.06446
13	156.25	.05778
14	48.75	.05178
15	55	.05046
16	110	.04237
17	72.5	.04113
18	201.25	.03828
19	137.5	.03549
20	130	.03525

83.6-03 V/EA 3.16+00 E VLG

C

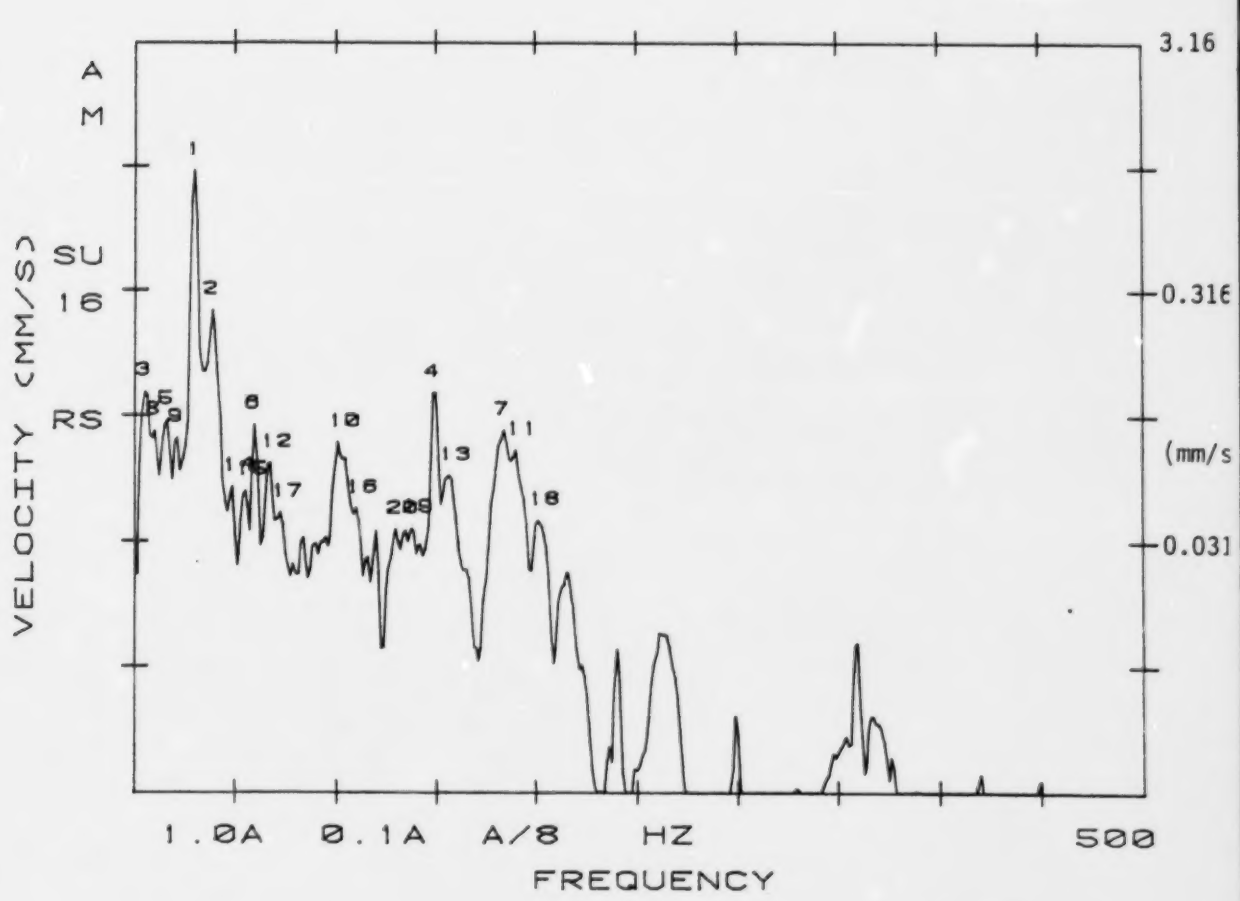


FIGURE F26

172766 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#9
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.03661
2	60	.01478
3	149.5	.01151
4	119.5	4.670E-03
5	19.5	4.638E-03
6	22.5	4.418E-03
7	25.5	4.282E-03
8	21.5	4.024E-03
9	32	3.943E-03
10	5	3.885E-03
11	17.5	3.88E-03
12	89.5	3.73E-03
13	7.5	3.477E-03
14	14.5	3.416E-03
15	12	3.141E-03
16	10	3.128E-03
17	35	3.111E-03
18	39	3.095E-03
19	37.5	3.008E-03
20	30.5	2.955E-03

4.72+00 V/EA 100.-03 E VLG

C

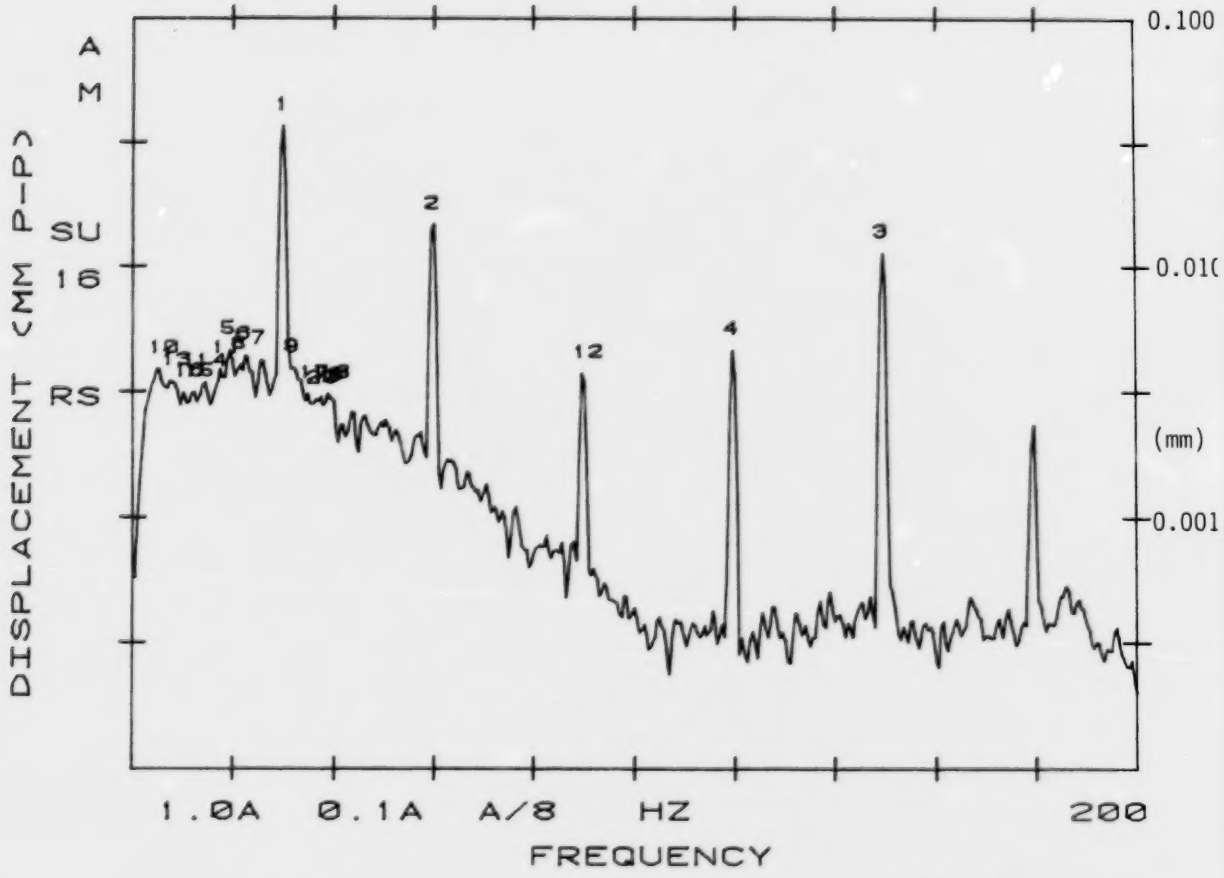


FIGURE F27

172767 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#9
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.03726
2	60	.01527
3	150	.01062
4	5	6.368E-03
5	17.5	6.299E-03
6	37.5	6.299E-03
7	238.75	6.24E-03
8	23.75	6.04E-03
9	12.5	5.676E-03
10	478.75	4.811E-03
11	120	4.4E-03
12	90	3.895E-03
13	50	3.631E-03
14	268.75	3.577E-03
15	298.75	3.519E-03
16	47.5	3.298E-03
17	448.75	3.298E-03
18	53.75	2.88E-03
19	328.75	2.762E-03
20	208.75	2.37E-03

4.72+00 V/EA 100.-03 E VLG

C

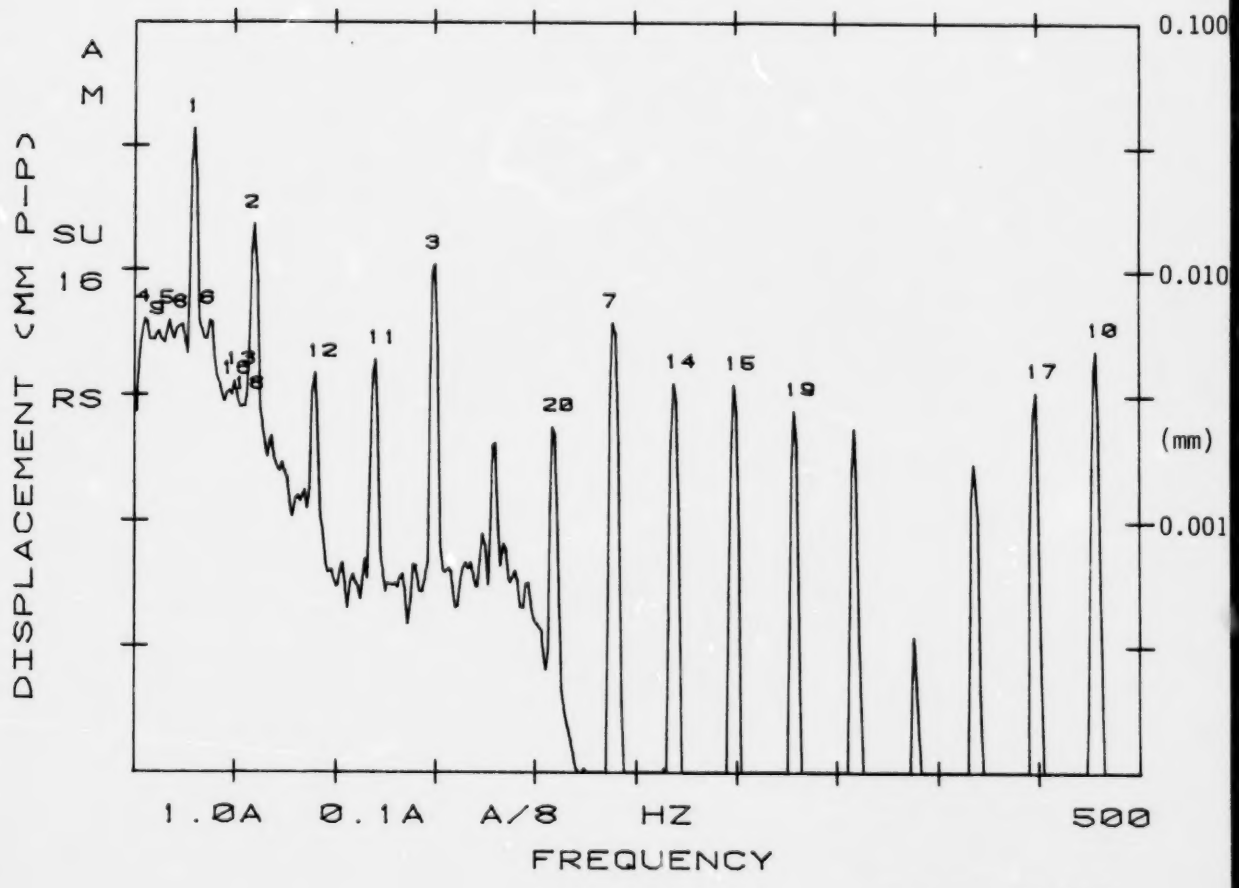


FIGURE F28

172768 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#10
REACTOR POWER 99% 07/23/86

PEAK_NO.	FREQUENCY	AMPLITUDE
1	30	1.009
2	149.5	.3172
3	8.5	.2094
4	38.5	.1826
5	40.5	.1683
6	24.5	.1482
7	42.5	.109
8	10.5	.102
9	119.5	.08304
10	60	.08292
11	138.5	.08049
12	87	.06973
13	178	.06945
14	34	.06842
15	179.5	.06777
16	54	.06403
17	32.5	.05739
18	13	.05227
19	15.5	.05046
20	182.5	.04992

83.6-03 V/EA 3.16+00 E VLG

C

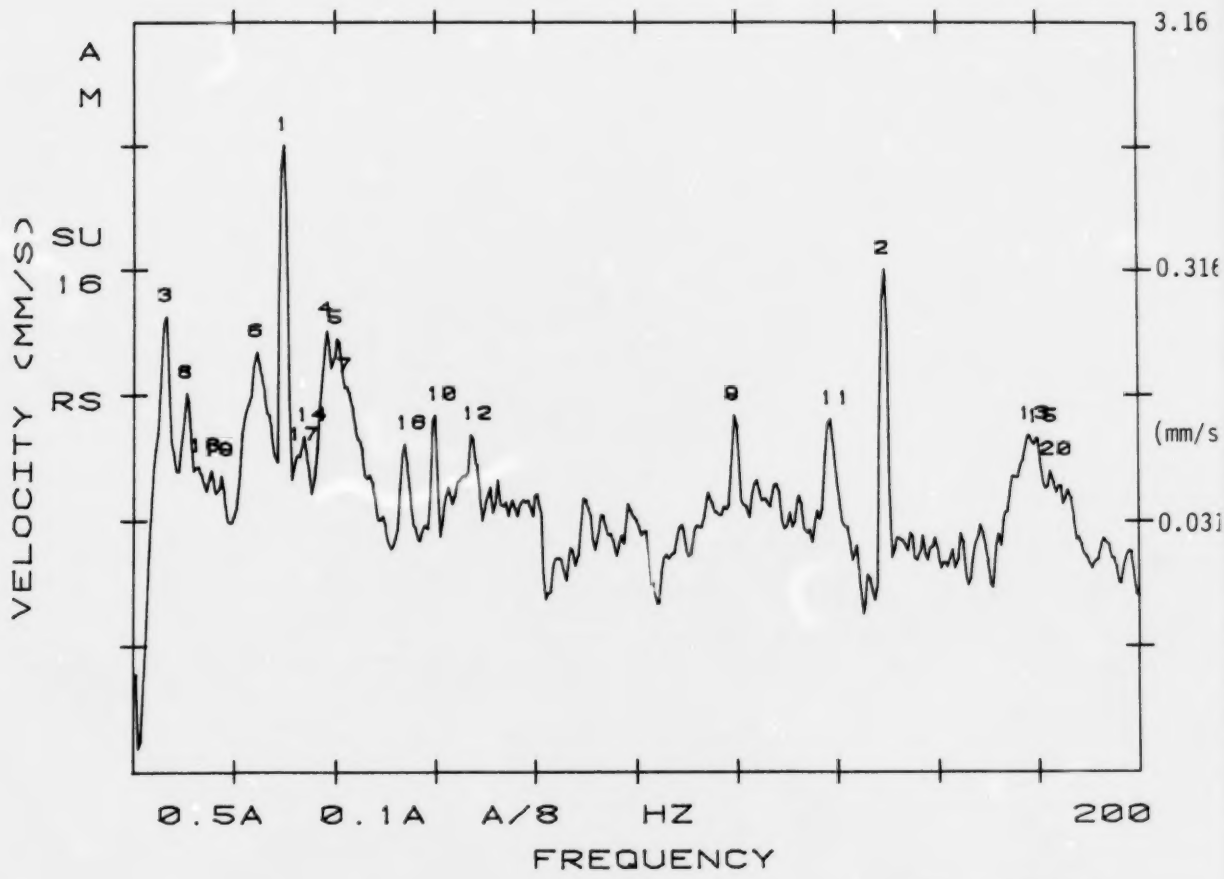


FIGURE F29

172769 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#10
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	1.053
2	150	.2801
3	38.75	.2785
4	6.25	.2018
5	25	.1949
6	11.25	.1406
7	120	.1174
8	178.75	.1055
9	138.75	.1034
10	87.5	.09862
11	80	.09586
12	72.5	.08327
13	15	.07824
14	127.5	.07381
15	53.75	.07213
16	113.75	.05833
17	80	.05466
18	93.75	.05312
19	98.75	.05213
20	188.75	.04722

83.6-03 V/EA 3.16+00 E VLG

C

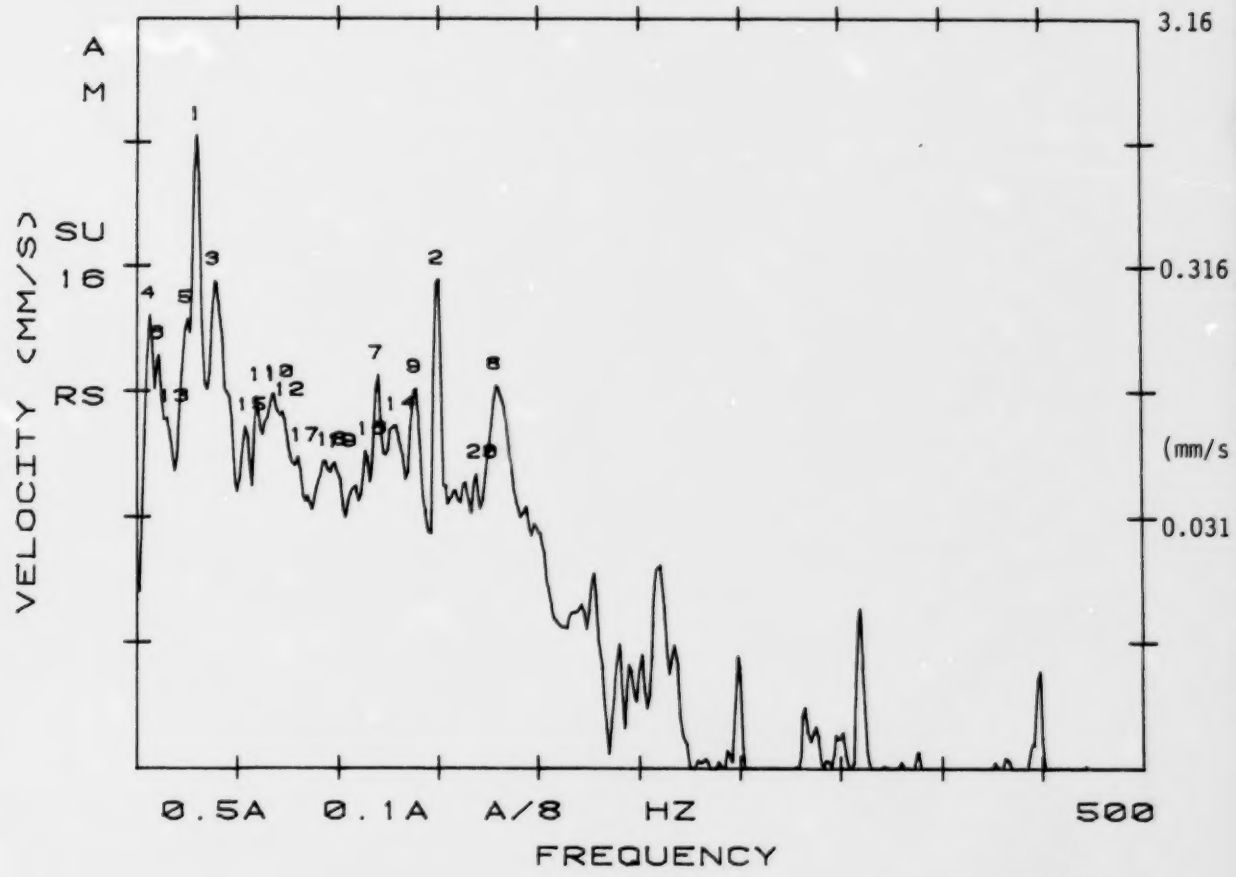


FIGURE F30

172770 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#10
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.07184
2	60	.02087
3	119.5	.0155
4	89.5	8.461E-03
5	17	7.361E-03
6	15	7.058E-03
7	13	6.316E-03
8	32	6.065E-03
9	149.5	5.975E-03
10	25	5.784E-03
11	30	4.798E-03
12	179.5	4.376E-03
13	22.5	4.254E-03
14	41	3.761E-03
15	38.5	3.329E-03
16	50	3.307E-03
17	9.5	3.258E-03
18	43	3.214E-03
19	68.5	3.103E-03
20	53.5	3.080E-03

4.72+00 V/EA 316.-03 E VLG

C

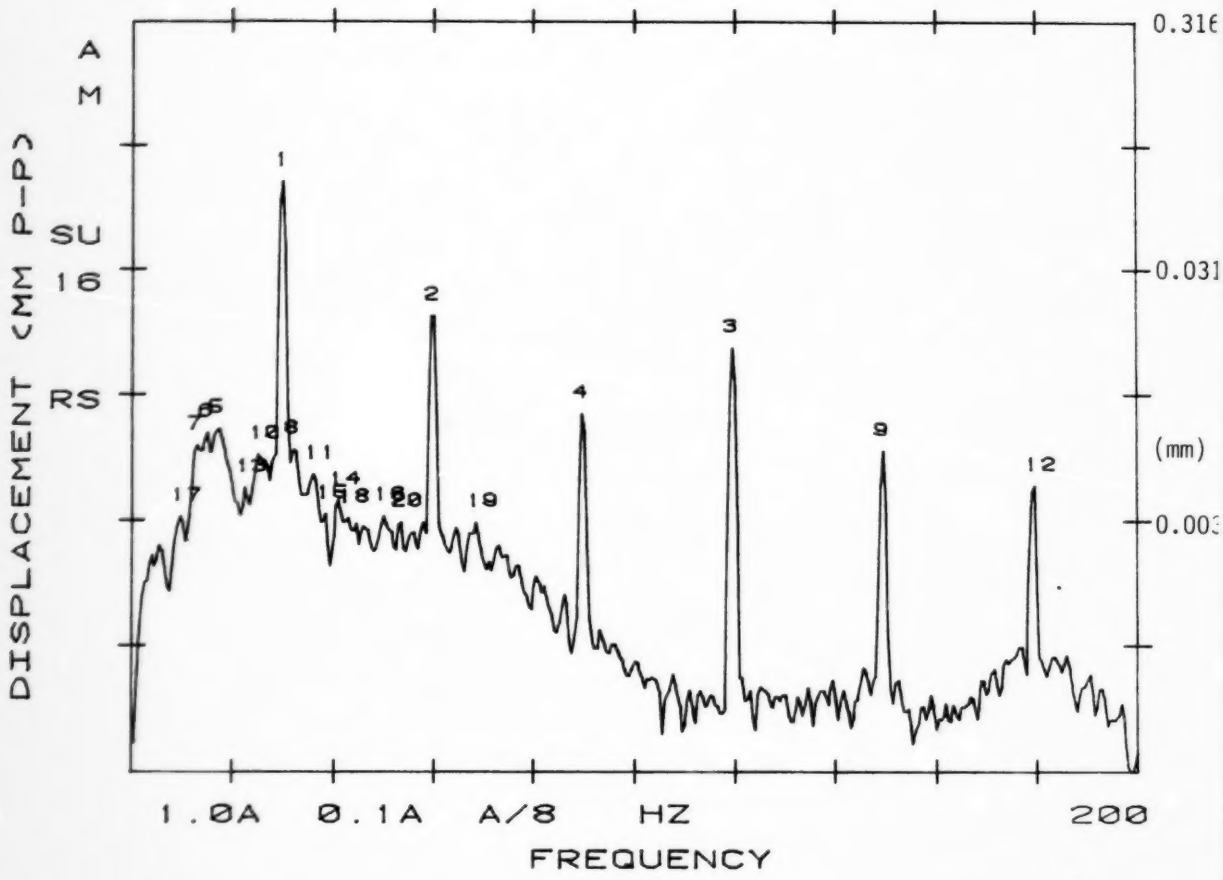


FIGURE F31

172771 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#10
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.07502
2	60	.02292
3	120	.01452
4	238.75	.01268
5	25	.01065
6	18.75	9.968E-03
7	16.25	9.86E-03
8	90	8.67E-03
9	268.75	8.124E-03
10	37.5	5.768E-03
11	388.75	5.539E-03
12	298.75	4.576E-03
13	68.75	4.557E-03
14	65	4.388E-03
15	47.5	4.259E-03
16	43.75	4.095E-03
17	178.75	4.046E-03
18	150	3.869E-03
19	72.5	3.791E-03
20	328.75	2.904E-03

4.72+00 V/EA 316.-03 E VLG

C

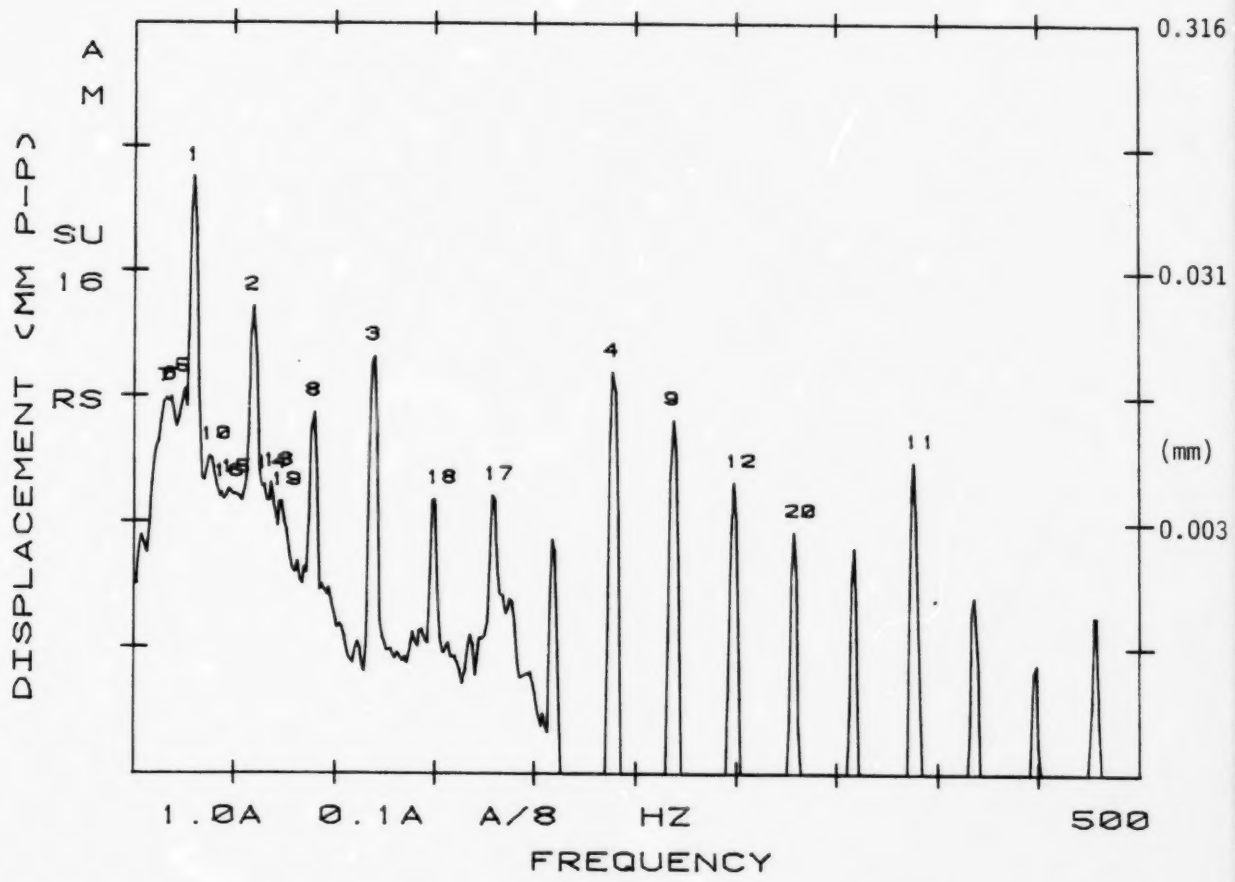


FIGURE F32

172772 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#11
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	1.03
2	149.5	.9693
3	6	.2035
4	33	.1295
5	119.5	.1171
6	37.5	.1165
7	20.5	.1078
8	39.5	.0938
9	60	.08543
10	26.5	.08405
11	10	.0836
12	93.5	.08147
13	3.5	.07677
14	69	.07059
15	41.5	.0703
16	44	.06945
17	24.5	.06889
18	23	.06651
19	91.5	.06499
20	65	.05833

83.6-03 V/EA 3.16+00 E VLG

C

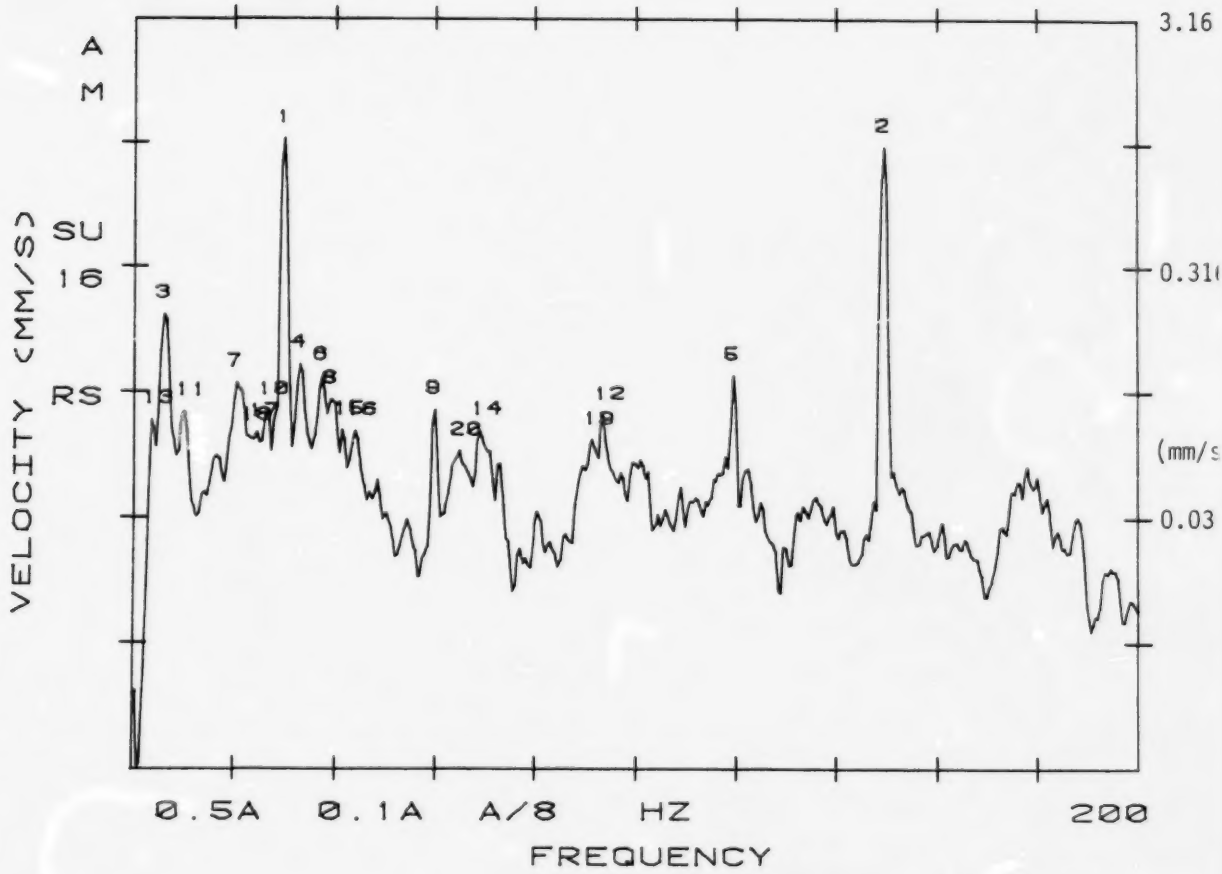


FIGURE F33

172773 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#11
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	1.073
2	150	.8604
3	6.25	.3034
4	21.25	.1789
5	37.5	.1513
6	60	.1217
7	92.5	.1071
8	65	.1002
9	120	.1001
10	70	.09204
11	15	.07898
12	101.25	.07481
13	118.25	.07421
14	177.5	.07011
15	111.25	.06268
16	51.25	.0588
17	108.25	.05298
18	137.5	.05277
19	88.25	.0515
20	186.25	.05115

83.6-03 V/EA 3.16+00 E VLG

C

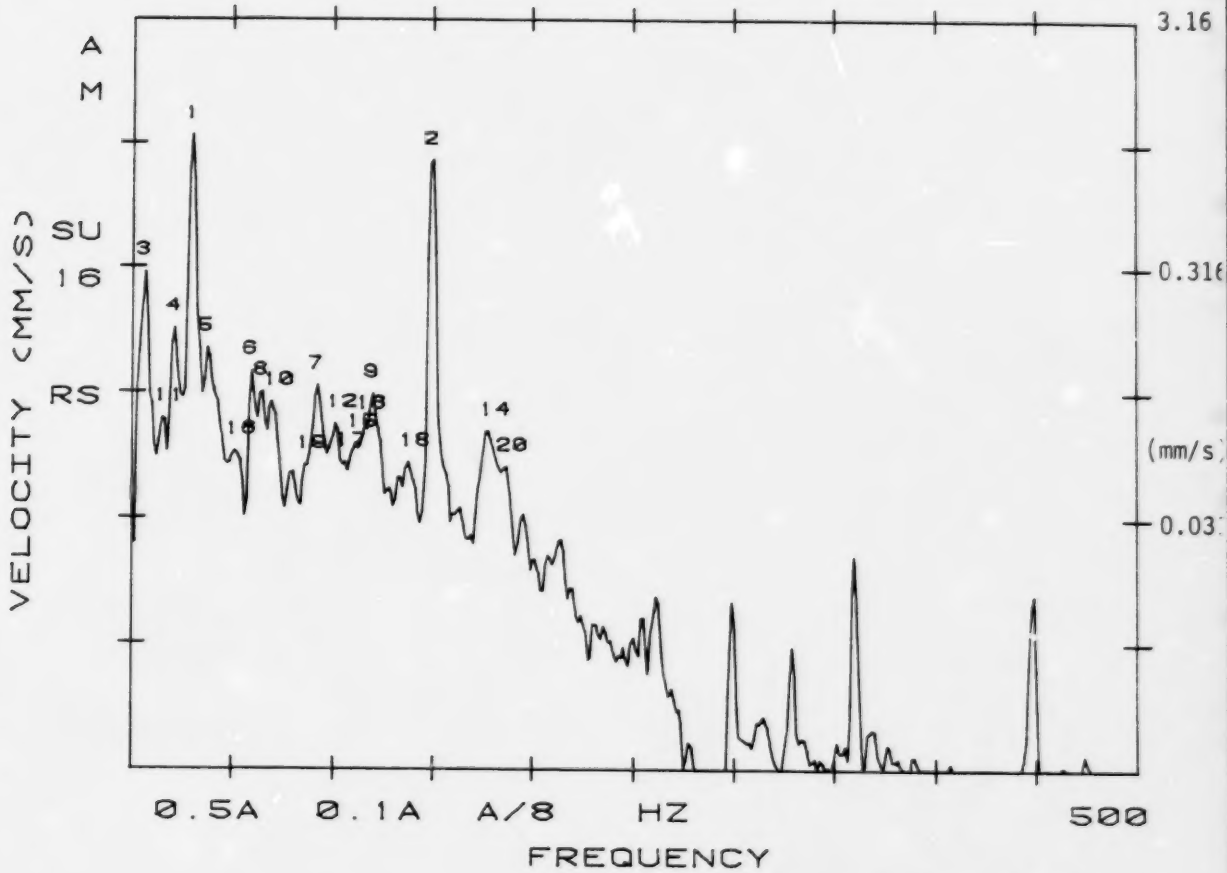


FIGURE F34

172774 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#11
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.05277
2	15	7.811E-03
3	17	6.351E-03
4	18.5	5.991E-03
5	149.5	5.699E-03
6	28	5.34E-03
7	13	5.176E-03
8	25.5	4.89E-03
9	10.5	4.857E-03
10	23.5	4.472E-03
11	110.5	4.441E-03
12	33.5	4.242E-03
13	37.5	4.129E-03
14	39.5	3.932E-03
15	89.5	3.89E-03
16	45	3.631E-03
17	47	3.298E-03
18	36	3.236E-03
19	48	3.236E-03
20	58	2.988E-03

4.72+00 V/EA 316.-03 E VLG

C

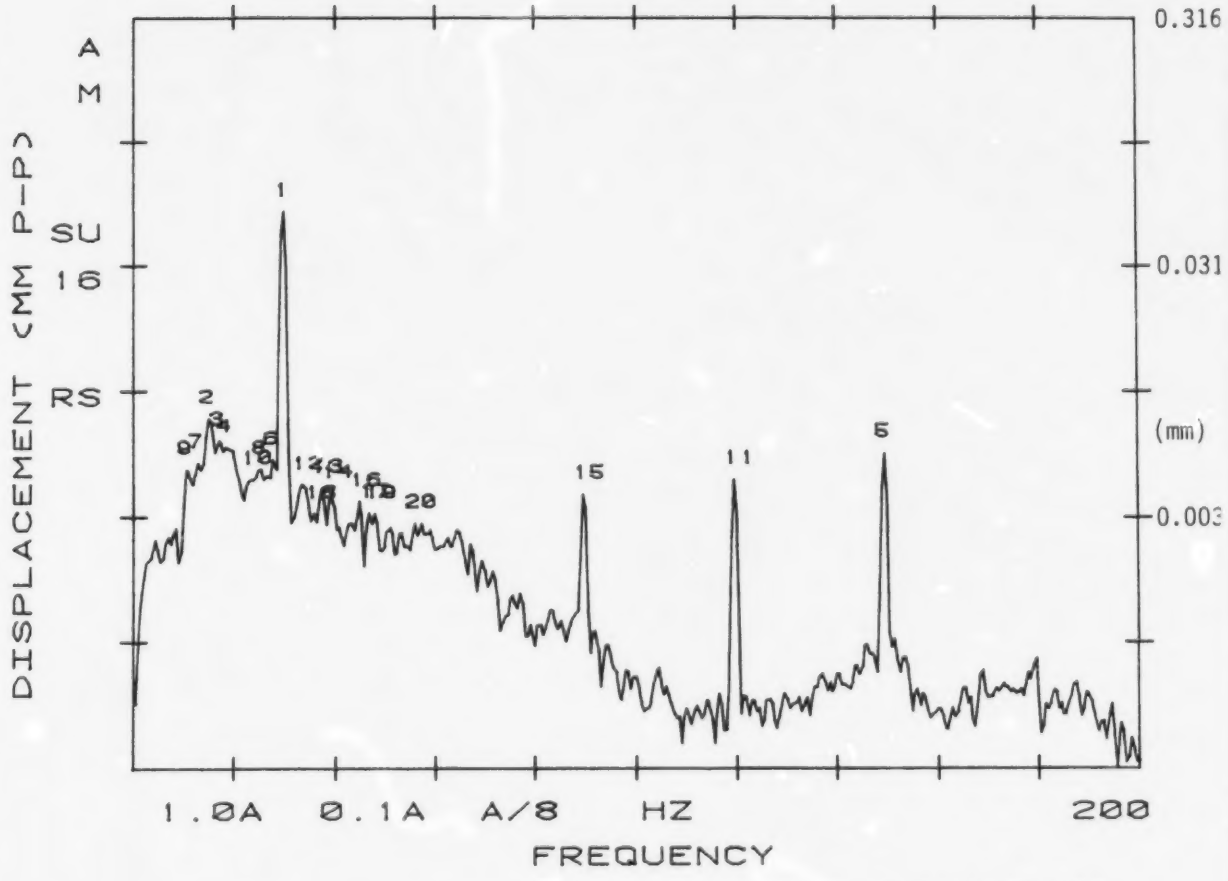


FIGURE F35

172775 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#11
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.05466
2	16.25	.01286
3	150	6.907E-03
4	37.5	5.354E-03
5	42.5	4.557E-03
6	48.75	4.508E-03
7	52.5	4.358E-03
8	120	4.271E-03
9	90	4.242E-03
10	57.5	4.057E-03
11	63.75	4.051E-03
12	68.25	4.040E-03
13	5	3.827E-03
14	75	2.758E-03
15	83.75	2.351E-03
16	478.75	2.348E-03
17	95	1.524E-03
18	208.75	1.494E-03
19	172.5	1.434E-03
20	298.75	1.384E-03

4.72+00 V/EA 316.-03 E VLG

C

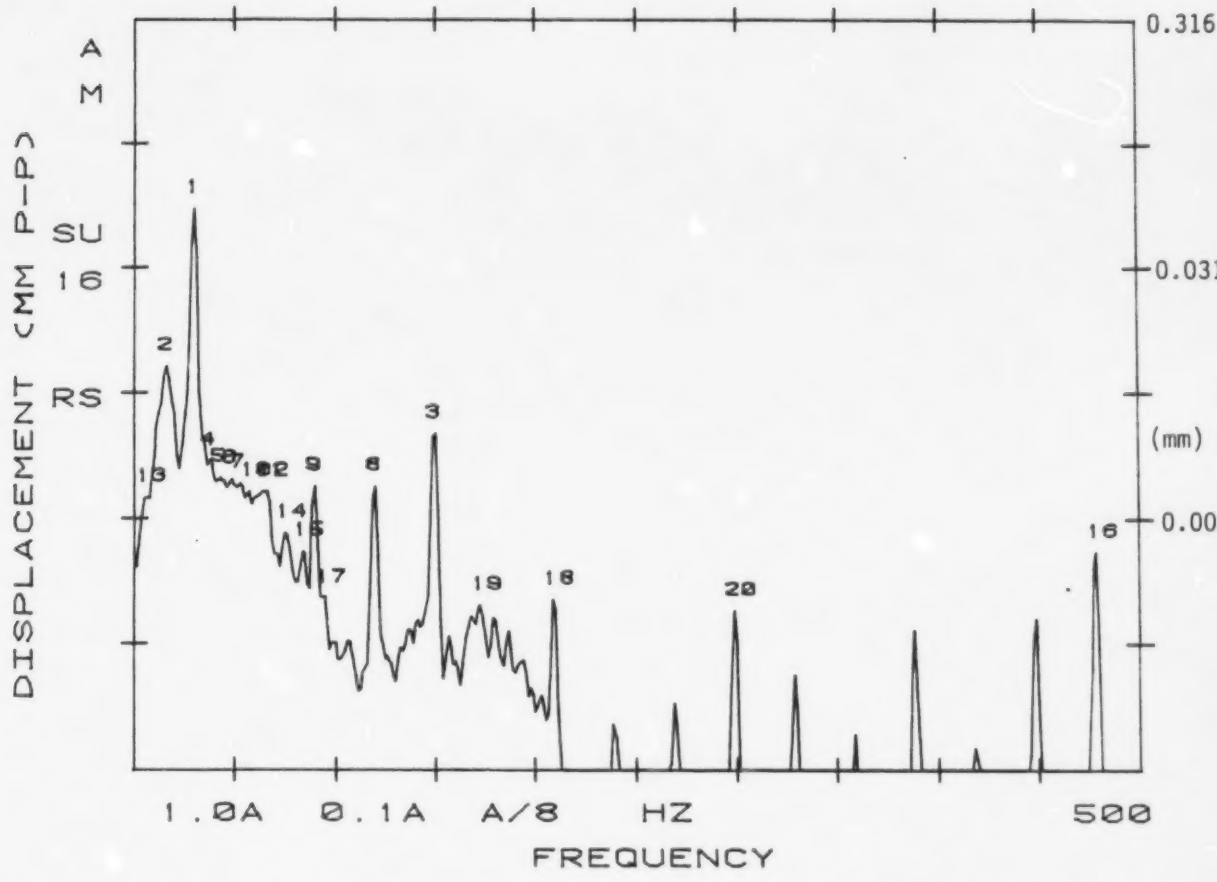


FIGURE F36

172776 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#13
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	149.5	.3767
2	30	.2231
3	21.5	.1478
4	24	.09822
5	3.5	.09756
6	10	.08708
7	60	.05548
8	14	.05012
9	16.5	.04492
10	110.5	.03965
11	72	.03348
12	43.5	.03325
13	32	.03214
14	39.5	.03201
15	98	.03099
16	38	.0307
17	92.5	.03033
18	95.5	.02978
19	70	.02819
20	90	.02774

83.6-03 V/EA 3.16+00 E VLG

C

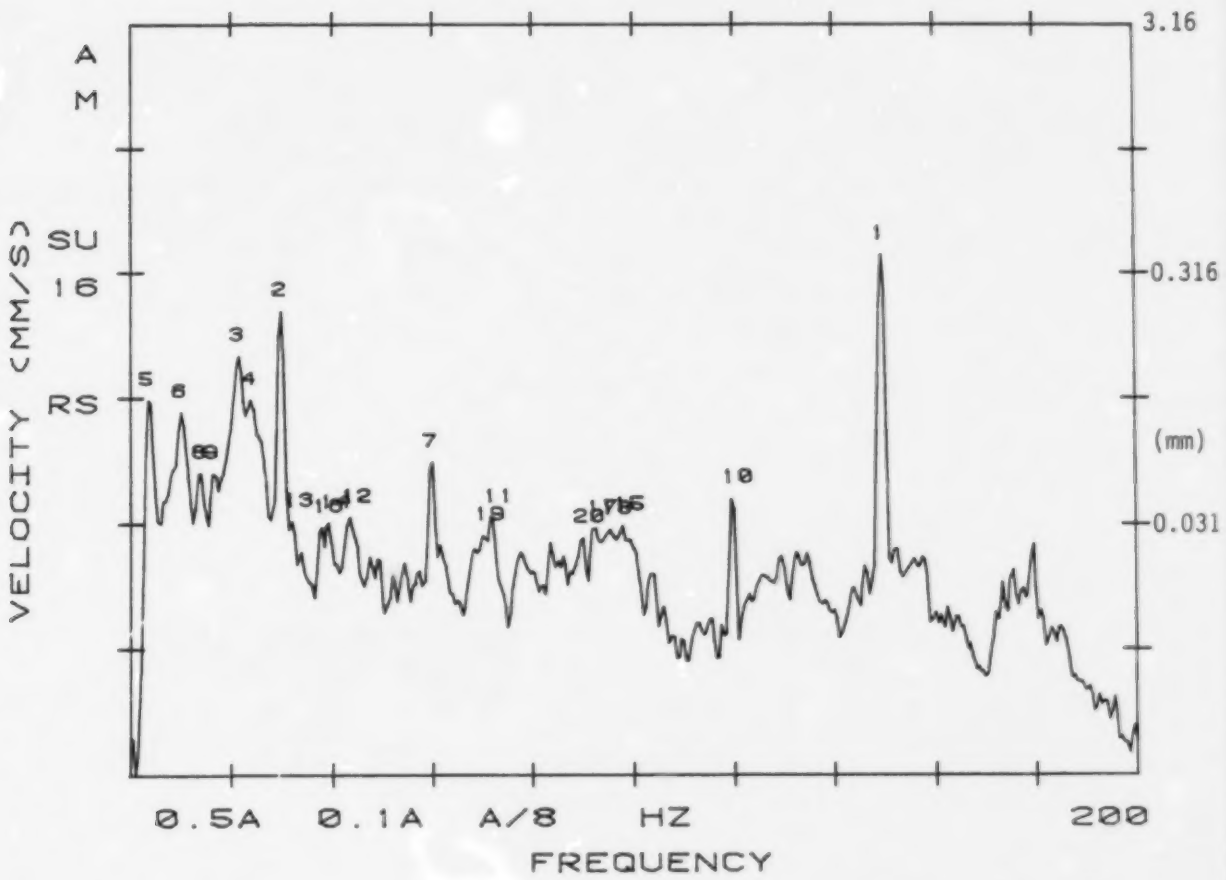


FIGURE F37

172777 RD

PICKERING NGS "B" UNIT#8
MAIN HEAT TRANSPORT PUMP#13
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	150	.4267
2	30	.2274
3	21.25	.2008
4	3.75	.1043
5	10	.1034
6	38.75	.05191
7	60	.04978
8	120	.04627
9	133.75	.04449
10	47.5	.04237
11	91.25	.04197
12	71.25	.04175
13	100	.0413
14	95	.04008
15	55	.03849
16	178.75	.03711
17	83.75	.03232
18	81.25	.03167
19	161.25	.03099
20	137.5	.02952

83.6-03 V/EA 3.16+00 E VLG

C

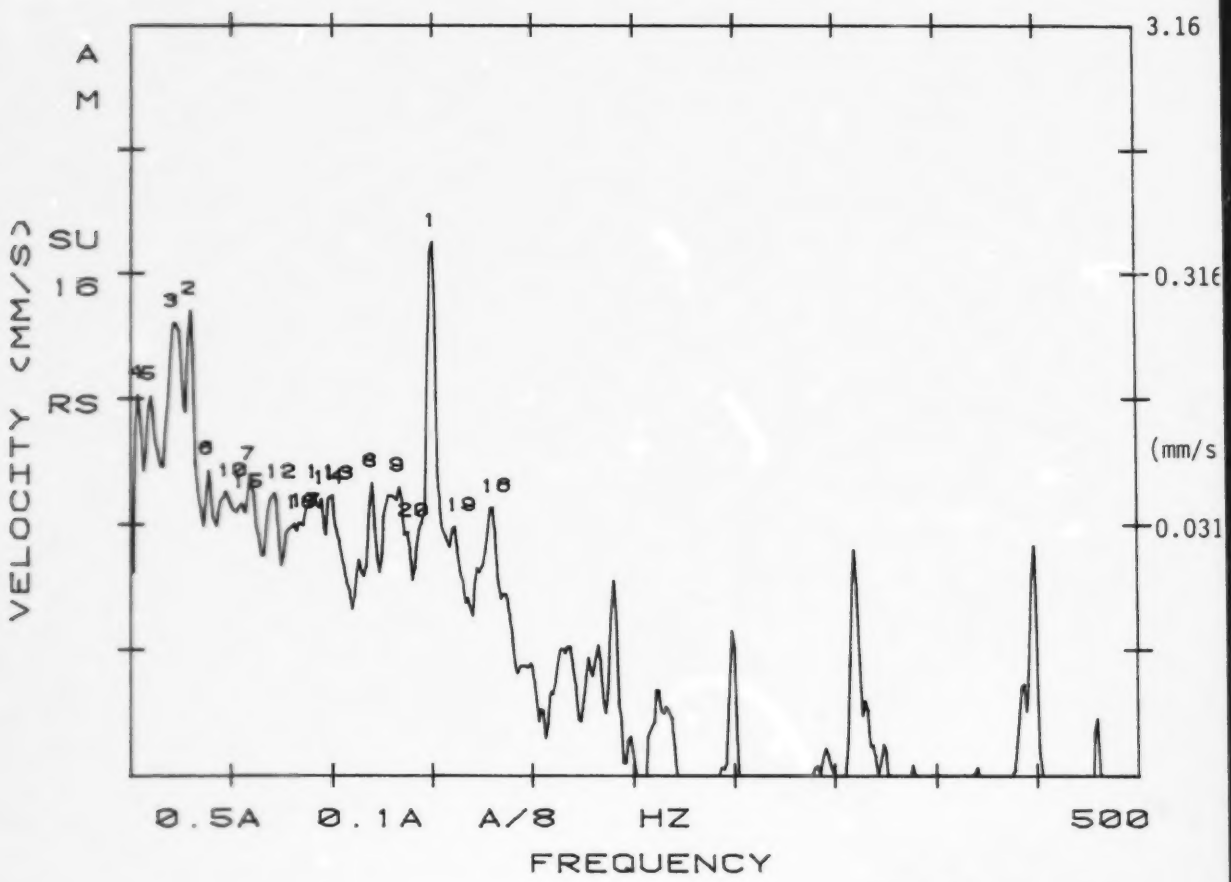


FIGURE F38

172778 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#13
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.01072
2	149.5	8.84799999E-03
3	60	7.261E-03
4	16.5	6.147E-03
5	89.5	5.561E-03
6	15	5.413E-03
7	18.5	5.1E-03
8	179.5	4.551E-03
9	119.5	4.09E-03
10	20.5	3.827E-03
11	24	3.827E-03
12	11.5	3.188E-03
13	27	3.004E-03
14	2.5	2.951E-03
15	4.5	2.924E-03
16	7	2.924E-03
17	8.5	2.519E-03
18	36	2.297E-03
19	34.5	2.282E-03
20	32.5	2.269E-03

4.72+00 V/EA 31.6-03 E VLG

C

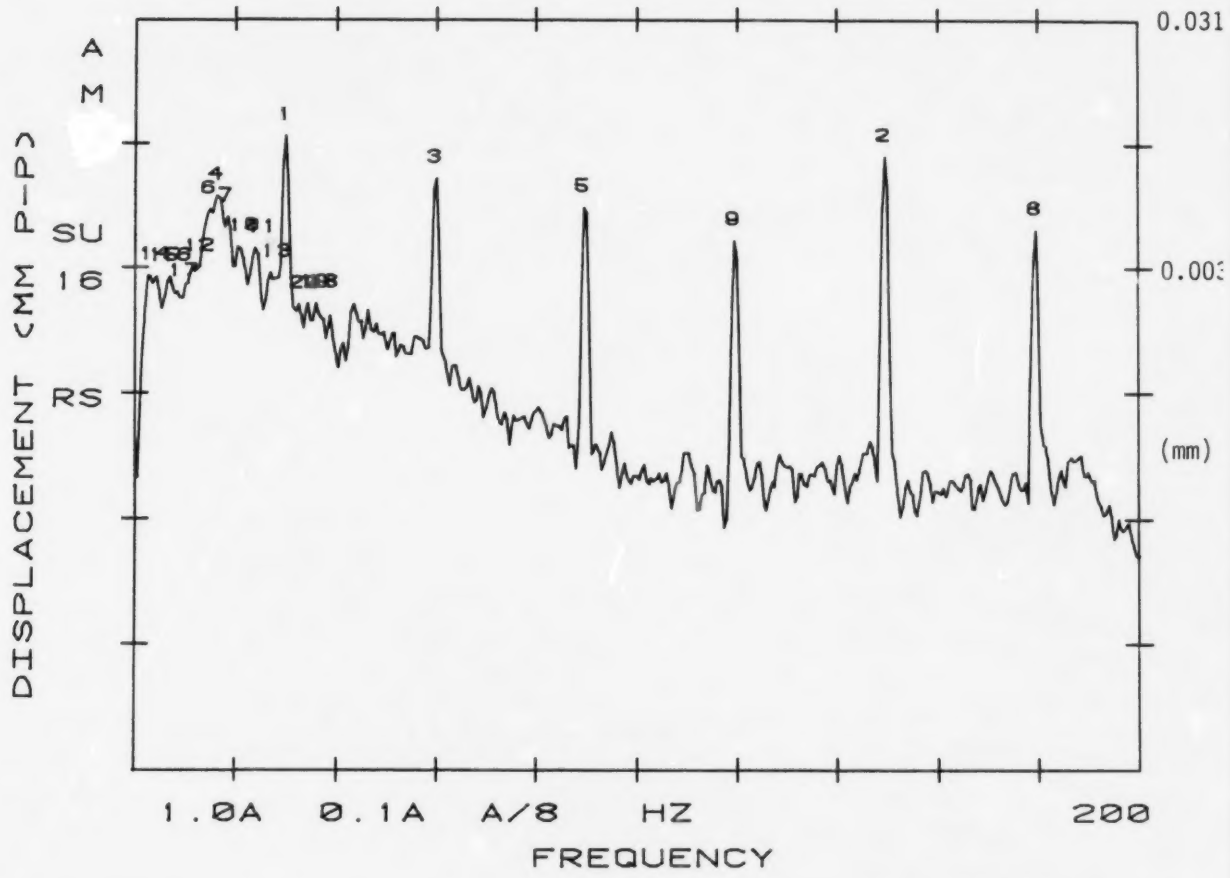


FIGURE F39

172779 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#13
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.01165
2	15	9.185E-03
3	150	8.038E-03
4	60	6.786E-03
5	22.5	5.831E-03
6	90	5.768E-03
7	5	4.956E-03
8	238.75	4.576E-03
9	120	4.242E-03
10	180	4.173E-03
11	478.75	3.685E-03
12	37.5	3.665E-03
13	45	3.085E-03
14	51.25	2.849E-03
15	268.75	1.658E-03
16	68.75	1.588E-03
17	208.75	1.549E-03
18	72.5	1.472E-03
19	328.75	1.385E-03
20	81.25	1.249E-03

4.72+00 V/EA 31.6-03 E VLG

C

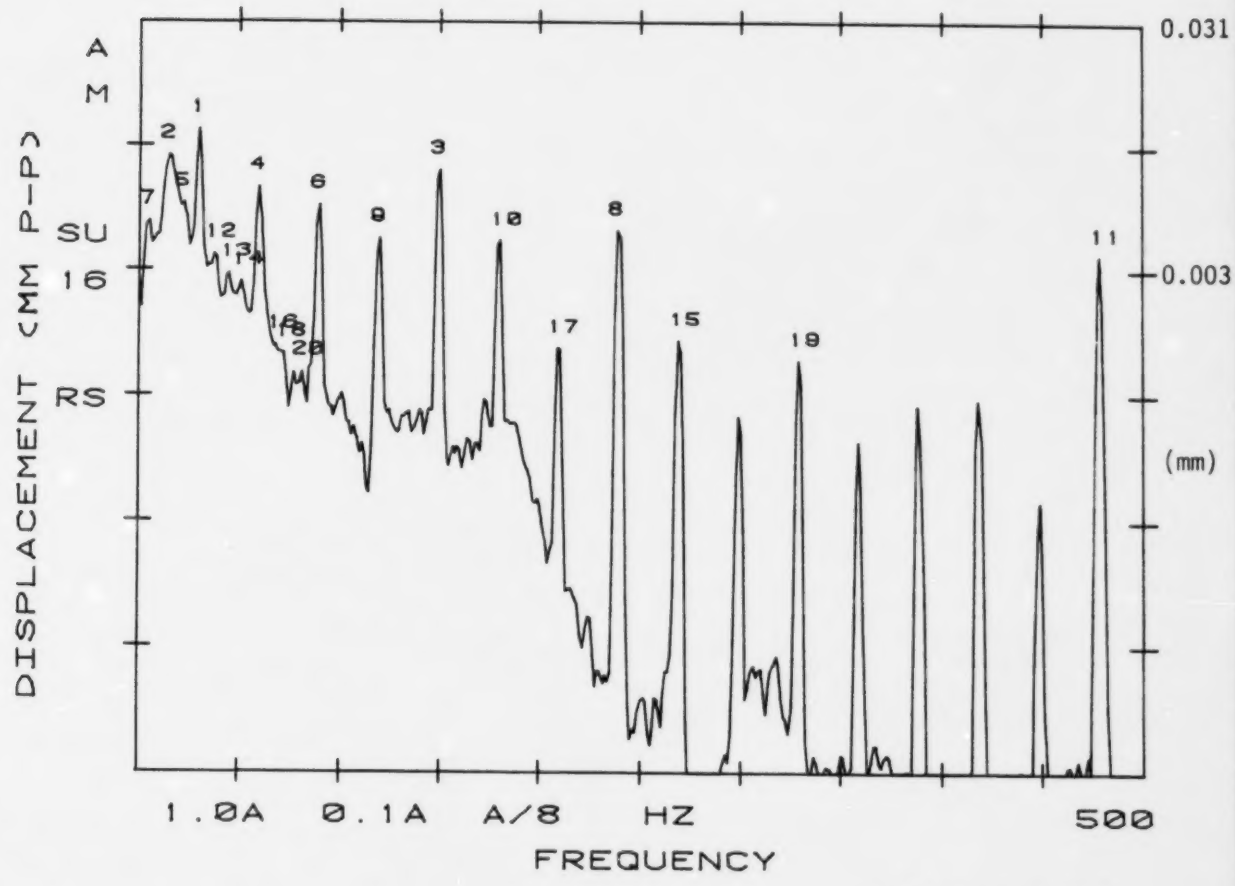


FIGURE F40

172780 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#15
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	149.5	2.349
2	30	.8604
3	5	.4199
4	27	.3079
5	33	.287
6	31.5	.252
7	60	.2407
8	41	.233
9	69	.233
10	22.5	.2010
11	120	.1478
12	10	.1406
13	47	.1383
14	38	.1348
15	134	.1337
16	45.5	.1314
17	48	.1282
18	43.5	.1207
19	65.5	.1102
20	13.5	.1092

83.6-03 V/EA 31.6+00 E VLG

C

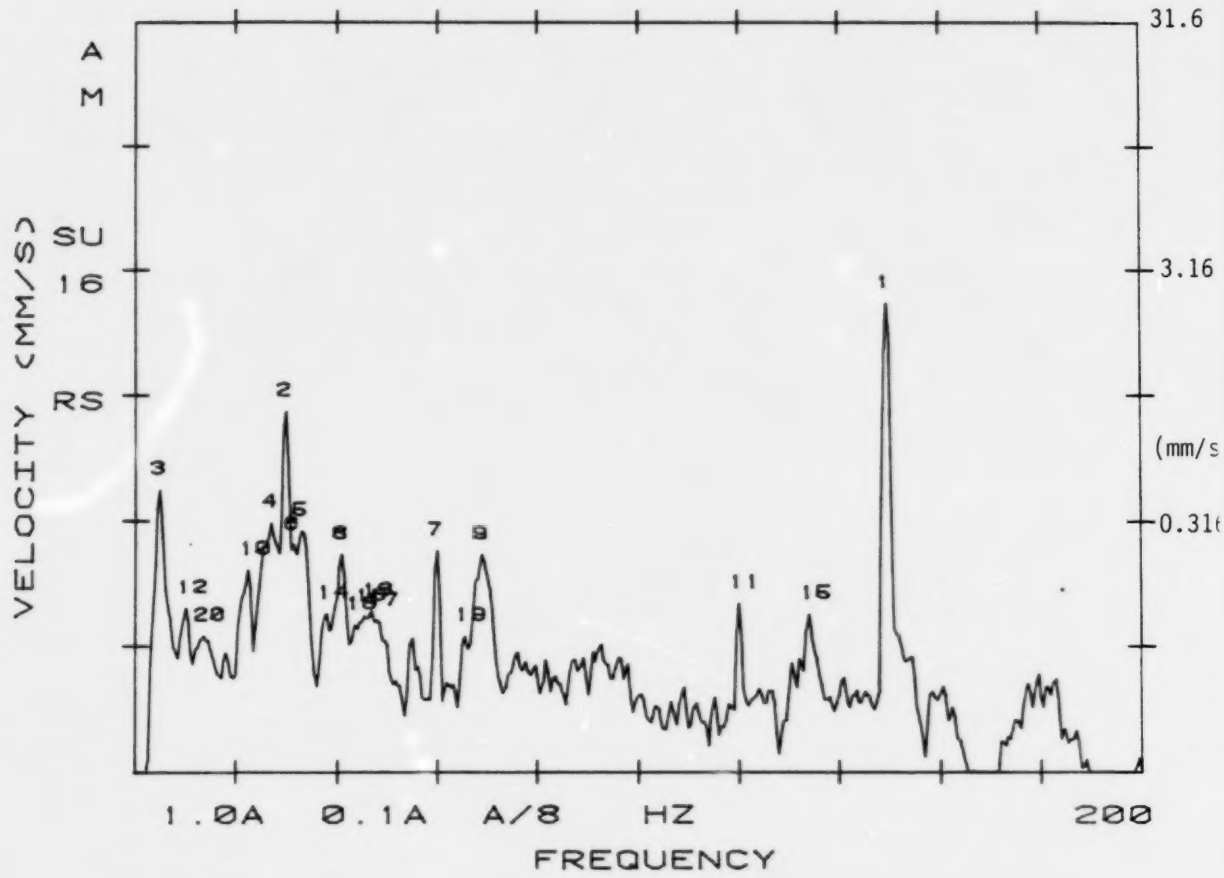


FIGURE F41

172781 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#15
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	150	2.274
2	30	.8408
3	5	.4775
4	70	.3013
5	41.25	.2848
6	80	.2586
7	10	.2252
8	45	.2088
9	37.5	.1981
10	133.75	.1851
11	15	.1833
12	50	.1632
13	120	.1619
14	88.75	.1571
15	77.5	.1529
16	178.75	.1387
17	82.5	.1295
18	55	.1253
19	95	.1245
20	125	.1195

83.6-03 V/EA 10.0+00 E VLG

C

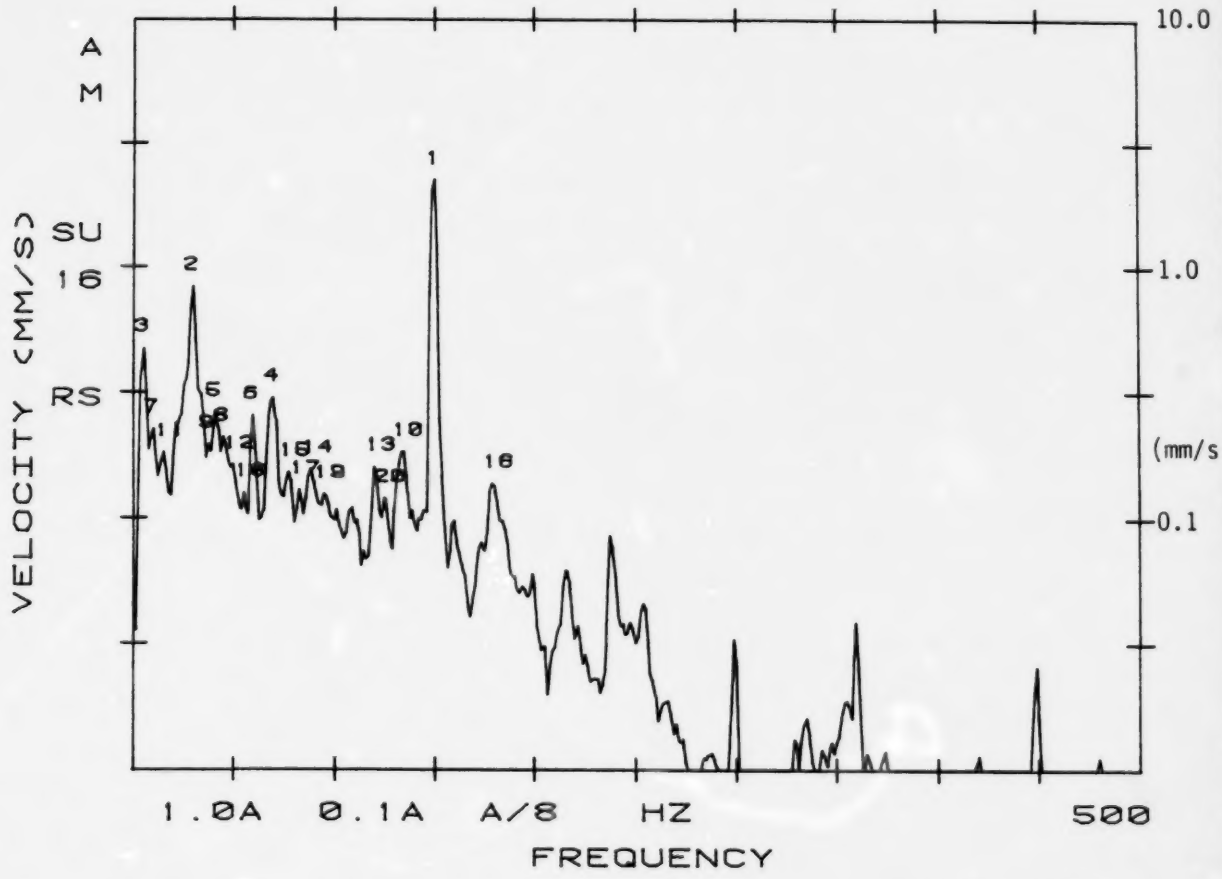


FIGURE F42

172782 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#15
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.01556
2	60	.01138
3	149.5	8.124E-03
4	16	4.824E-03
5	13.5	4.418E-03
6	26	4.151E-03
7	24.5	4.1E-03
8	18	3.959E-03
9	21.5	3.916E-03
10	22.5	3.864E-03
11	34.5	3.449E-03
12	3	3.361E-03
13	36.5	3.188E-03
14	89.5	3.116E-03
15	32.5	2.931E-03
16	6.5	2.721E-03
17	4.5	2.714E-03
18	39	2.627E-03
19	8.5	2.543E-03
20	44	2.512E-03

4.72+00 V/EA 100.-03 E VLG

C

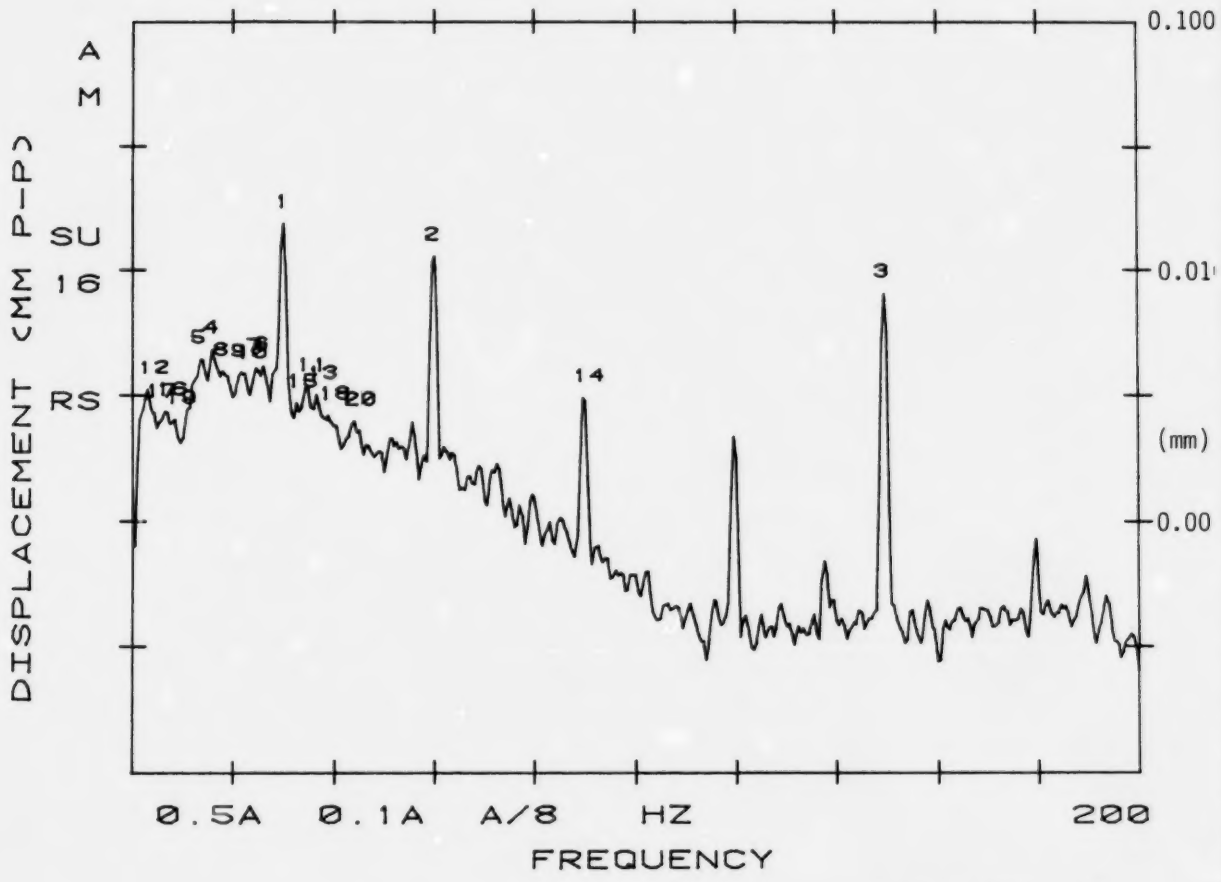


FIGURE F43

172783 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#15
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.01603
2	60	.01163
3	150	8.07E-03
4	15	7.481E-03
5	25	5.935E-03
6	21.25	5.614E-03
7	2.5	4.863E-03
8	38.75	3.989E-03
9	238.75	3.853E-03
10	8.75	3.73E-03
11	90	3.361E-03
12	50	3.158E-03
13	45	3.133E-03
14	53.75	2.943E-03
15	71.25	2.522E-03
16	120	2.039E-03
17	81.25	1.88E-03
18	76.25	1.823E-03
19	328.75	1.4E-03
20	208.75	1.124E-03

4.72+00 V/EA 100.-03 E VLG

C

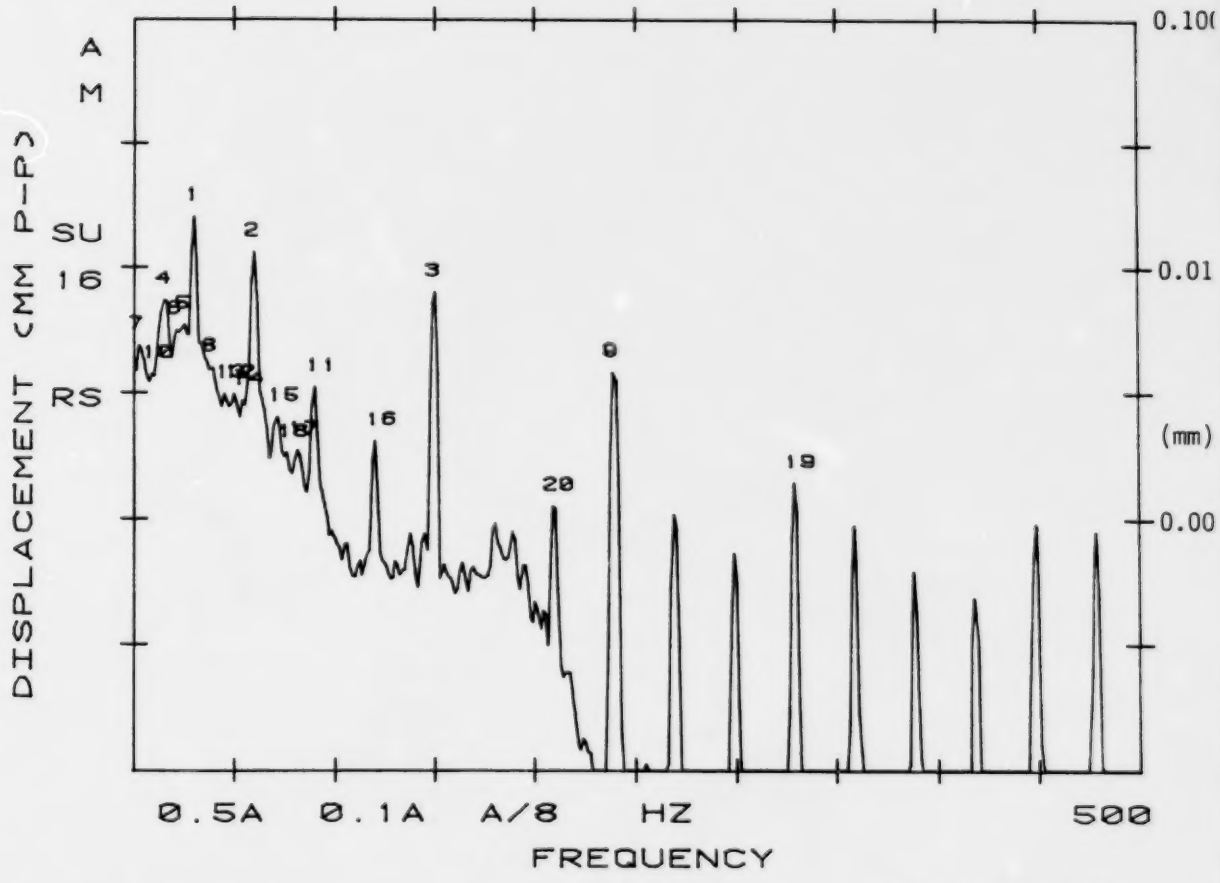


FIGURE F44

172784 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#16
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	3.882
2	149.5	1.107
3	21.5	.448
4	28	.3977
5	60	.3455
6	3.5	.3362
7	79.5	.1647
8	81	.161
9	77.5	.155
10	72	.1515
11	17	.1509
12	34	.1423
13	75	.1361
14	69	.1323
15	67.5	.1303
16	146.5	.123
17	38.5	.1228
18	73.5	.1178
19	64.5	.1165
20	120	.1086

83.6-03 V/EA 10.0+00 E VLG

C

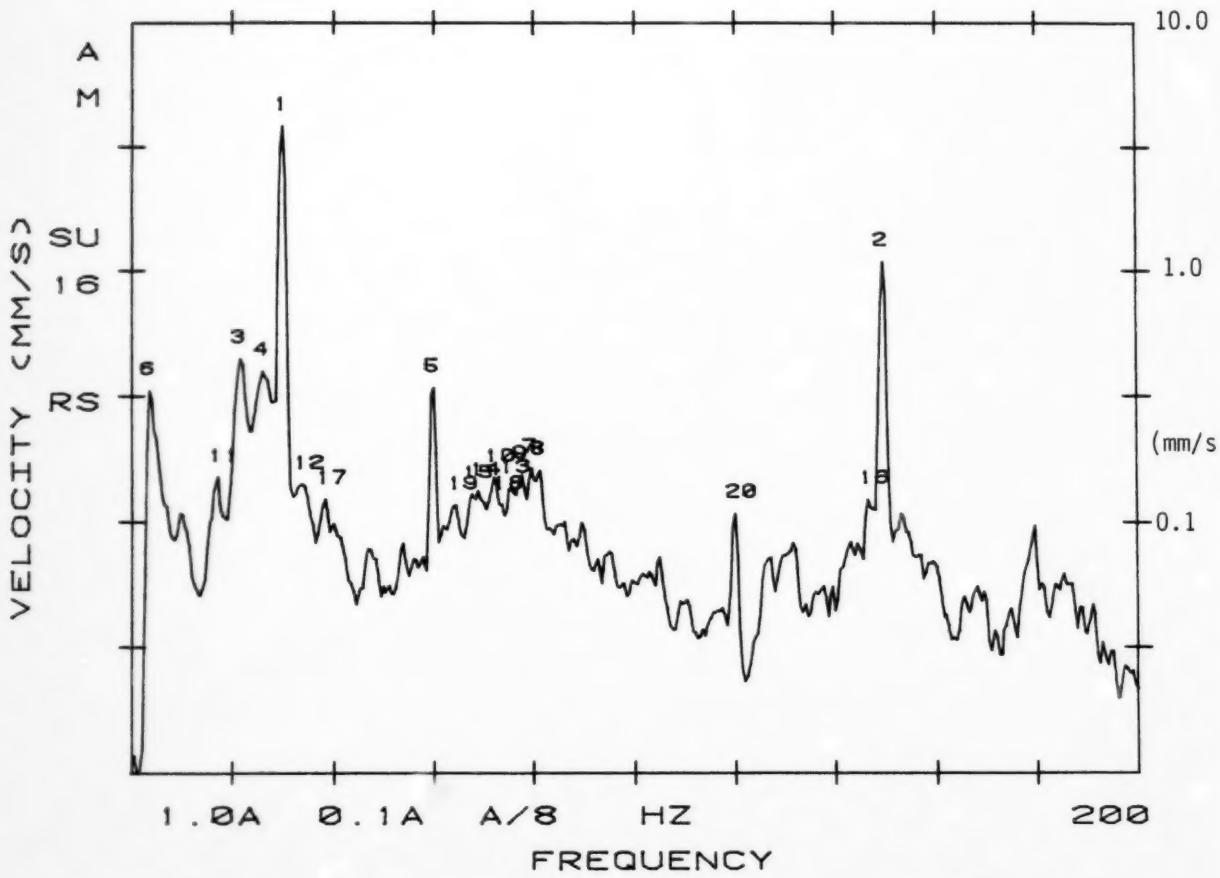


FIGURE F45

172785 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#16
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	3.851
2	150	1.264
3	21.25	.5708
4	3.75	.5008
5	60	.4187
6	76.25	.2483
7	72.5	.2375
8	16.25	.2336
9	82.5	.2314
10	65	.1986
11	68.75	.1986
12	90	.1981
13	40	.1907
14	10	.1429
15	157.5	.1159
16	95	.1157
17	132.5	.1157
18	50	.114
19	161.25	.111
20	178.75	.1101

83.6-03 V/EA 10.0+00 E VLG

C

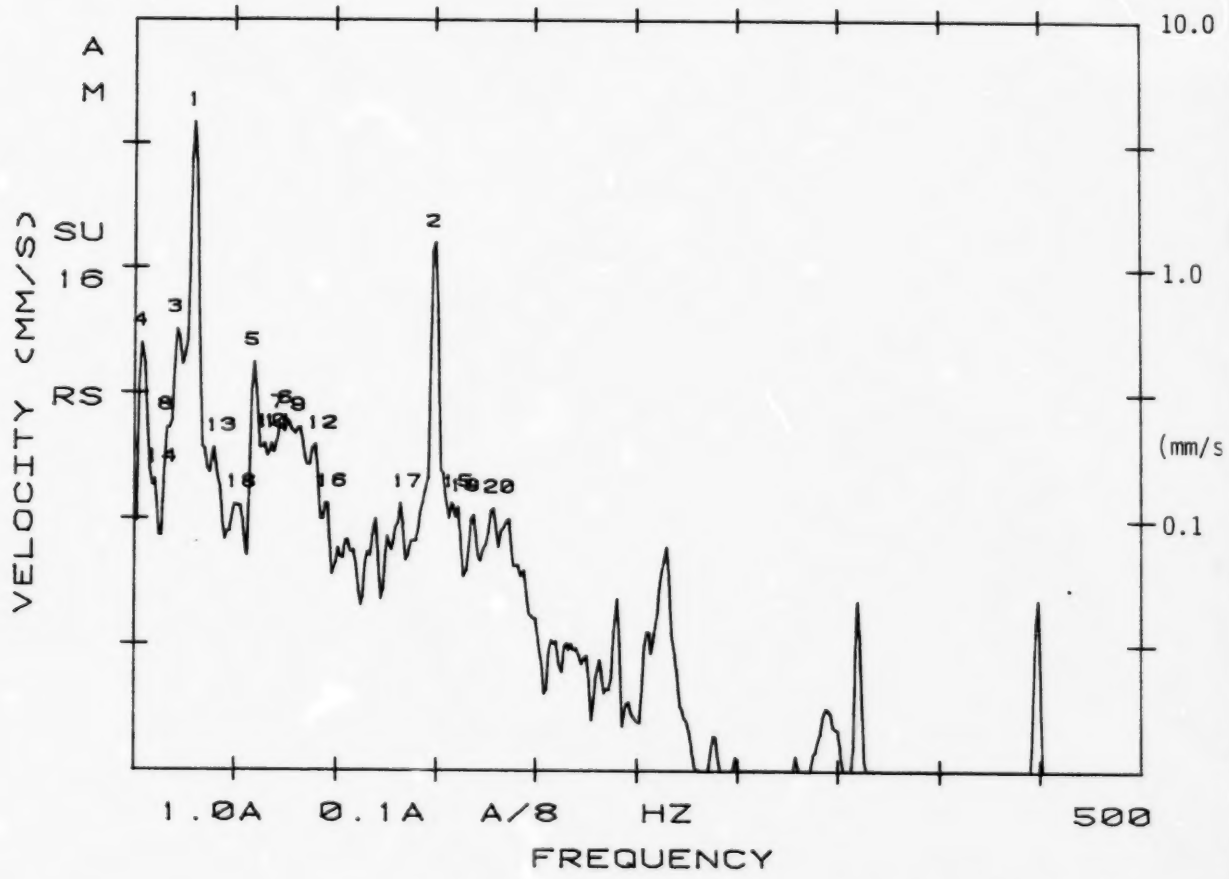


FIGURE F46

172786 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#16
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.01845
2	149.5	.01326
3	89.5	6.623E-03
4	16.5	4.557E-03
5	19.5	4.388E-03
6	26.5	4.335E-03
7	27.5	4.282E-03
8	60	4.276E-03
9	13.5	3.88E-03
10	24.5	3.563E-03
11	32	3.543E-03
12	22.5	3.28E-03
13	4	2.988E-03
14	38	2.842E-03
15	2.5	2.819E-03
16	35	2.721E-03
17	58	2.591E-03
18	40	2.581E-03
19	11	2.553E-03
20	36.5	2.519E-03

4.72+00 V/EA 100.-03 E VLG

C

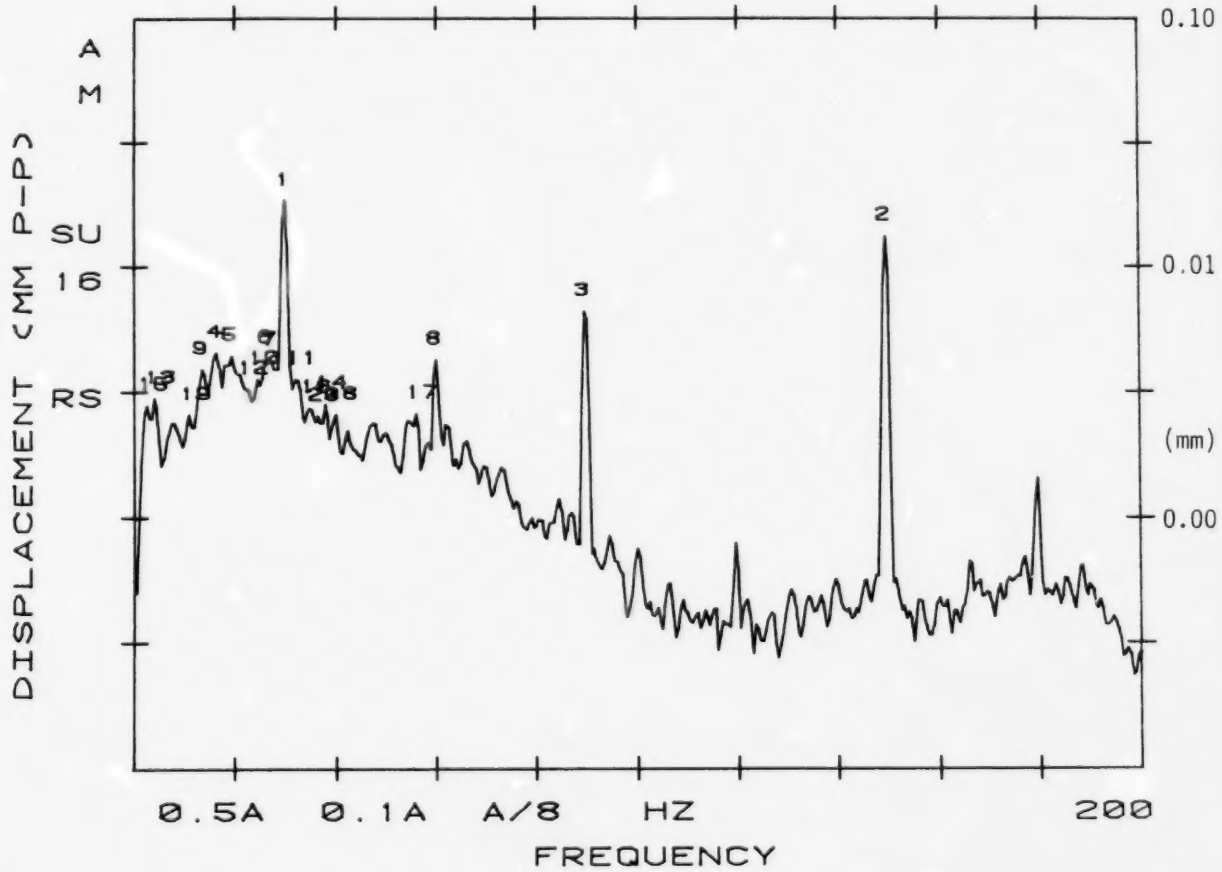


FIGURE F47

172787 RD

PICKERING NGS"B" UNIT#8
MAIN HEAT TRANSPORT PUMP#16
REACTOR POWER 99% 07/23/86

PEAK NO.	FREQUENCY	AMPLITUDE
1	30	.01697
2	150	.01241
3	90	7.106E-03
4	16.25	6.507E-03
5	22.5	5.66E-03
6	60	4.779E-03
7	5	4.533E-03
8	36.25	4.472E-03
9	42.5	4.095E-03
10	46.25	3.343E-03
11	63.75	3.325E-03
12	55	3.141E-03
13	51.25	2.769E-03
14	72.5	2.462E-03
15	238.75	2.073E-03
16	268.75	1.977E-03
17	298.75	1.937E-03
18	180	1.685E-03
19	78.75	1.647E-03
20	328.75	1.518E-03

4.72+00 V/EA 100.-03 E VLG

C

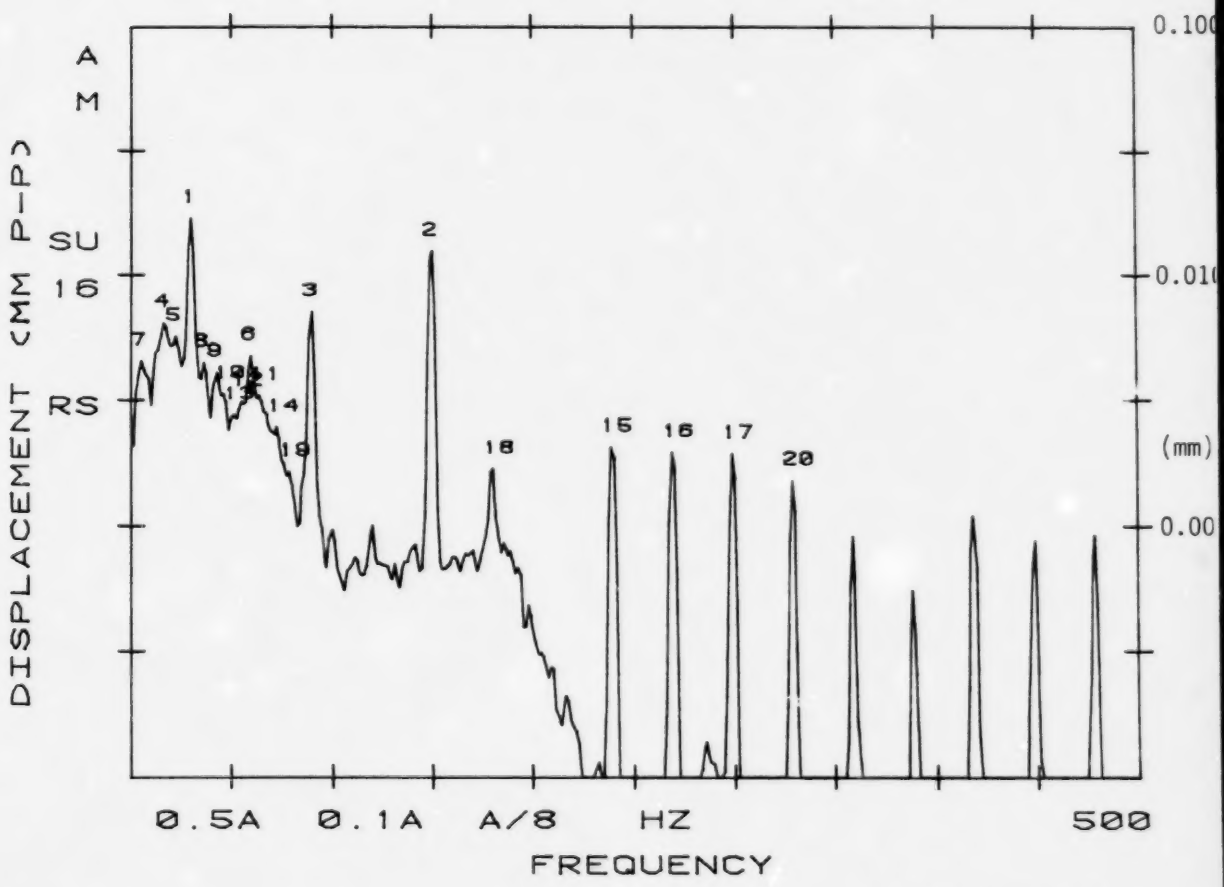


FIGURE F48

172788 RD

DATE: 07/23/86

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APPENDIX G

PICKERING B UNIT #8 PRESSURIZING AND CIRCULATING
PUMPSETS - TAPE RECORDS AT FULL LOAD
7.5 in/s

TR CH #	PUMP #	MEASUREMENT	TT	VMS AMP GAIN	
TAPE NAME	"PICKERING B U#8 FULL LOAD RECORDS"				
			0-125	Calibration. 3.54 V rms at 100 Hz. TR attenuation 5:1.	
4	PRESS 2	YE-1	1250	M	3 min record
5		YE-2	- 1370	M	DUFF
6		Ø			
1	PHT 1	YE-1	120-240	M	3 min record
2		YE-2		H	
3		Ø			
4	PHT 2	YE-1		M	
5		YE-2		H	
6		Ø			
7	PHT 4	YE-1		M	
8		YE-2		H	
9		Ø			
1	PHT 6	YE-1		M	
2		YE-2	240-360	H	
3		Ø			
4	PHT 7	YE-1		M	3 min record
5		YE-2		H	
6		Ø			
7	PHT 8	YE-1		M	
8		YE-2		H	
9		Ø			
1	PHT 9	YE-1	360-475	M	3 min record
2		YE-2		H	
3		Ø			
4	PHT 10	YE-1		M	
5		YE-2		H	
6		Ø			
7	PHT 11	YE-1		M	
8		YE-2		H	
9		Ø			

DATE: 07/23/86

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APPENDIX G

PICKERING B UNIT #8 PRESSURIZING AND CIRCULATING
PUMPSETS - TAPE RECORDS AT FULL LOAD
7.5 in/s

TR CH #	PUMP #	MEASUREMENT	TT	VMS AMP GAIN	
TAPE NAME	"PICKERING B UNIT #8 FULL LOAD RECORDS"				
1	PHT 13	YE-1	475-600	M	3 min record
2		YE-2		H	
3		Ø			
4	PHT 15	YE-1		M	
5		YE-2		H	
6		Ø			
7	PHT 16	YE-1		M	
8		YE-2		H	
9		Ø			
	PRESS = PRESSURIZING PUMP PHT = PRIMARY HEAT TRANSPORT PUMP YE-1 = SHAFT DISPLACEMENT (RUNOUT) YE-2 = VIBRATION VELOCITY Ø = PHASE MAKER				

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